ECONOMIC ANALYSIS OF FISHERIES PROJECTS

Shyam S. Salim
R. S. Biradar
S.K. Pandey

CENTRAL INSTITUTE OF FISHERIES EDUCATION
Deemed University, Indian Council of Agricultural Research
Fisheries University Road, Seven Bungalows,
Andheri (W), Mumbai - 400 061.

FOREWORD

Project formulation is an important part of entrepreneurship development. Fisheries sector, hosting a gamut of entrepreneurship venture, corroborates the importance of technical know how in project planning, formulation and implementation. Diverse information in projects targeted at a heterogeneous group has been modified to suit the needs of an entrepreneur seeking assistance in his venture. This book on "Economic Analysis of Fisheries Projects" contains citations and applications, which caters to the needs of professional graduates and postgraduates in fisheries. The book by Dr. Shyam S. Salim, Dr. R.S. Biradar and Mr. S.K. Pandey of Fisheries Informatics, Technology Evaluation and Transfer Division of this institute deals the subject in a simple and systematic manner to meet the requirements and expectations of the students of fishery science. I am sure that the manual would also serve as a useful handbook to research workers and entrepreneurs.

Dr. S.C. Mukherjee
Director, CIFE, Mumbai.

05-07-2004
Mumbai

PREFACE

Fisheries sector in India has witnessed an impressive growth from a subsistence traditional activity to a well developed commercial and diversified enterprise. The fisheries sector has been playing a pivotal role in the Indian economic development by virtue of its potential contribution to employment generation, income augmentation, addressing food and nutrional security concern and forex earnings. Over the last two decades the fisheries sector emerged as one of the fastest growing food sectors in the world. Growing urbanisation, globalisation and changing social structure had a major impact on the fisheries scenario of the country. Inorder to sustatin the faster growth, developmental projects and programmes need to be formulated, implemented and managed scientifically. This book is intended to fulfill the long felt need of having a comprehensive reference material for fisheries project planning, formulation and management.

This book on "Economic Analysis of Fisheries Projects" is an outgrowth based on the interactions with aspirants for entrepreneurship development and with the students at CIFE, Mumbai during the last few years. This book is intended to cater to the needs of students, entrepreneurs and researchers on all aspects of project, formulation, appraisal implementation and management.

This book elucidates various methodologies involved in formulation of a project. Guidelines from standard textbooks and inputs from real field experiences were accounted in every step of its preparation. References have been cited for helping the interested readers for pursuing their study in detail.

Shyam S. Salim
R. S. Biradar
S.K. Pandey

05-07-2004
Mumbai

CONTENTS

Part - I

Projects-Concept and Scope

CHAPTER 1

PROJECTS - CONCEPT AND SCOPE

Introduction

A developing country like India is generally faced with the problem of a rapidly growing population. The rapid growth of population has created problems of unemployment and under employment in such countries. An underdeveloped country suffers from a chronic deficiency of capital resources. The capital per capita is very low to the tune of $350. It is the opinion of most demographers that population pressures are likely to increase still further in future in the under developed countries. As such it become necessary to step up the rate of development in order to outstrip the rate of population increase.

There is a universal clamour in the underdeveloped countries for quick and accelerated "Economic Growth" within the shortest possible time. Prof. Rostow, defines economic growth as the relation between the rates of increase in capital and working force on one hand and increase in population on the other such that per capita output is rising. Thus per capita output (income) becomes the test of economic growth.

Therefore, it is better to emphasize the need for comprehensive economic planning for a backward, under developed economy on the ground that it assures a high rate of economic growth through a quicker process of capital formation. Hence, sound and effective planning is necessary for development and again this planning will be a success with good projects and both move together.

What is a Project?

Project is an investment activity in which financial resources are expended to create capital assets that produce benefits over an extended period of time. That's why projects are often referred to as the cutting edge of development. Project preparation is clearly not the only aspect of fisheries development or planning. Identification of national fisheries development objectives, selecting priority areas for investment, designing effective price policies, and mobilizing resources are all critical. Unless, projects are carefully prepared in substantial detail, inefficient or even wasteful expenditure is almost sure to result- a tragic loss in nations short of capital.

Often projects form a clear and distinct portion of a larger, less precisely identified programme. Again, all we can say in general about a project is that it is an activity for which money will be spent in expectation of returns and which logically, seems to lend itself to planning, financing and implementing as a unit. It is a specific activity, with a specific starting point and as a specific ending point, intended to accomplish specific objectives. Hence, project acts as a "time slice".

It will have a well-defined sequence of investment and production activities and a specific group of benefits, that we can identify, quantify and usually in fisheries projects, determine a money value for.

Its development can be pictured as a progression with many dimension- temporal, spatial, socio-cultural, financial, and economic. Projects can be seen as temporal and spatial units, each with a financial and economic value and a social input that make up the continuum.

Therefore, project is the smallest operational element prepared and implemented as a separate entity in national plan as a part of development.

A sound and effective plan for national aquaculture development depends upon a number of appropriate investment projects that are viable and contribute to national economy. Poorly identified and prepared investment projects often slow the development of a national aquaculture industry and waste scarce resources.

Virtually every developing country has a systematically elaborated national plan to hasten economic growth and further a range of social objectives. Project provides an important means by which investment and other development expenditure foreseen in plans can be clarified and realized. Sound development plans require good projects, just as good project require sound planning. The two are interdependent.

An investment- project may be anything from a single programme to an entire integrated programme that includes the entire following programme

a) Fish pond
b) Hatchery
c) Feed plant
d) Ice plant
e) Cold storage
f) Processing plant
g) Wholesale and retail market.
h) Training, Extension etc.

Classification of projects

I. Projects based on geographic boundary

These projects are described by their geography. Under this projects can be categorized into four types.

1) Single site projects

These may range from artisanal farm unit with production of a few tonnes to local but complete aquaculture development of a valley, lake, lagoon or bay producing collectively thousands of tonnes and employing many hundreds of people within a cooperate farming system or companies.

Example Chilka lake (in Orissa), Kolleru lake (in Andhra Pradesh)

2) Local projects

It involves many production units on different sites within the same zone. These may have one or more organisation and management responsibilities, often with a marked geographical discontinuity between them

Example Rice cum fish culture for a group of traditional rice farmers.

3) National projects

These may extend in several provinces where production is concentrated and possibly throughout the country. Such projects include many different activities and have components of production, demonstration, extension, training, research, processing, marketing and financing. These projects are generally targeted at specific beneficiaries to take the advantage of new technologies

and their opportunities. These can also be called as "Social projects".

Example Lab to land programs (ICAR 1979)

4) Regional projects

These may extend throughout several countries or all countries. These are mostly technical assistance projects with main objective to improve the exchange of information and dissemination of technology through components of services training, management and financial support in the acquisition of the foreign equipment.

Example Nigeria, Ivory Coast has well-established fish trading links, including shipping with developed countries.

II. Projects in relation to sector capacity

Projects intended to create new sectors

These are concerned with the developing capacity of the sector in areas where it has not existed before. It may take projects like construction of new farms or projects concerned with introduction of new species or may be adoption of new technologies to exploit the opportunities.

Projects designed to improve production of an existing sector

These are particularly important for aquaculture development at the present time, especially countries in Asia, where long established traditional techniques are followed but the yields are much below the effort level. Intensification of production has been achieved through projects with components of management, technical training, extension services, better feeds and improved equipment's and machineries.

Projects rehabilitation

These are important for non-productive and damaged sectors. For example in African countries where the potential economic returns are so limited that the forms are lost their interest completely in farming mainly because lack of financial support which invariably led to mismanagement. These projects are needed for both individual farmers as well as for community-based farmers.

III. Projects in relation to technical parameters

1. Projects involving only one species

These are usually small individual enterprises. When they are large they involve many producers together. They have been based either on production of low value species for increasing national consumption of cheap protein source or intense production to increase national income through exports.

Example intensification of Tilapia culture.

2. Projects based on single technology

These have a characteristic of bilateral and the private sector, both of which are interested in demonstrating and using a particular technology. These involve one species or a group of related

species and one particular phase of the production process or production requirements. Projects based on several technologies have been mostly for comparison and selection of the most appropriate technology for the area concerned or for demonstrating a range of options for technological transfer between partners. They have been more characteristics of regional cooperation projects where one objective is to facilitate dissemination of technologies form one country to another. For example, the introduction of technologies for sea bream, seabass, mullet, oyster, and mussel to a group of Mediterranean countries by the regional aquaculture development project.

3. Projects which address a single target group

These projects have been address to the rural poor or in some cases, one particular social categories. For example, fisherfolk in Versova. Regional development bank should give more emphasis on commercial projects, which involve intense production rather than substantial production, which should inturn helps the small-scale farmers in the surrounding area.

4. Projects involve one or more administrative bodies

Invariably, these are projects under one responsible ministry. However India inspite of its large catch of 5.6 m tons per annum, representing third position in the world, there is no ministry of fisheries. Instead there are over ten national organizations or agencies concerned with fisheries plus individual state organizations.

IV. Autonomous and induced projects

1. Autonomous projects

These are independent of the level of income, output, profitability or sales of the business forms. These are generally associated with factors like development of new resources, growth of population and technological innovations. Governments institute these projects.

2. Induced projects

These are related with current income, output, profitability, or sales. Profitability motive is the dominant factor of the induced projects. Private entrepreneurs generally start these projects.

Advantages of projects

1. The project gives us an idea of cost year by year, so that those responsible for providing the necessary resources can do their own planning. Project analysis tell us something about the effects of a proposed investment on the participants in the project, whether they are farmers, small farms, governments enterprises or the society as a whole.

2. Projects enable a better judgment about the administrative and organizational problems that will be encountered. It enables a strengthening of administrative arrangements; if these appear to be weak and tells something of the sensitivity of the return to the investment of managerial problem arise. The project gives both managers and planners better criteria for monitoring the progress of implementation.

3. The project encourages conscious and systematic examination of alternatives. The effects of a proposed project on national income and other objectives can conveniently be compared with the

effects of projects in other sectors, of other projects in the same sectors or very important of alternative formulations of virtually the same project.

4. Another advantage of the project is that it helps contain the data problem. In many developing countries, national data are unavoidable or are to a substantial degree, unreliable.

It is true that a project must be seen in a national context, but in many instances the direction that a countries development effort should take is well known, even if precise figure are not available. Most countries know they must increase food production even if they cannot cite reliable figures about total food production or recent growth rate.

Limitations of Projects

1. The quality of project analysis depends on the quality of the data used and of the forecasts of costs and benefits made.

To begin with, projects will exists in a changing technical environment. For some projects, the possibility of technological obsolescence will effect judgments about the attractiveness of the investment.

1. Techniques of projects analysis offer only limited help because future circumstances will change. One must judge the risks and uncertainty surrounding a project. It is impossible to quantify completely the risk of a project. We can however note that different kinds of projects or different formulation of essentially the same project may involve different degree of risk.These differences will affect the choice of project design. We can also test a project for sensitivity to change in some specific element, see how the benefits produced by the project will be affected and then judge how likely it is that such changes will occur and whether the changes in benefits will alter or willingness to proceed.

2. Project analysis is a species of what economists call " partial analysis". Normally we assume that the project themselves are too small in relation to the whole economy to have a significant effect on prices. In many instances, however a proposed project is relatively large in relation to national or regional economy. In this event we must adjust our assumption about future price levels to account for the impact of the project itself.

3. Another limitation of the project is an underlying conceptual problem about valuation based on the price system. The relative value of item in a price system depends on the relative weights that individuals participating in the system attach to the satisfaction they can obtain with their incomes. They choose among alternatives and thus the prices of goods and services balance with the values attached to these goods services by all that participate in the market.

Although project analysis must consciously be placed in a broader political and social environment, in general the effects of projects on this environment can be assessed only subjectively. Often economic refers to "externalities" or side effect, such as skill creation and the development of managerial abilities that are by-products of a project. Project may also be under taken to further many objectives, such as regional integration, job creations,beyond economic growth rate alone.

Conclusion

In the under development economics, project is not just a residual function of the political authorities. It is a mandatory assignment due to an imperative social need. Like in India, project planning is a very essential aspect under which the government concentrates its attention on some

selected projects, which are of great urgency and high priority. Depending on the extent and nature of development, the scope of activities would differ from project to project in given area as well as from area to area for a given project.

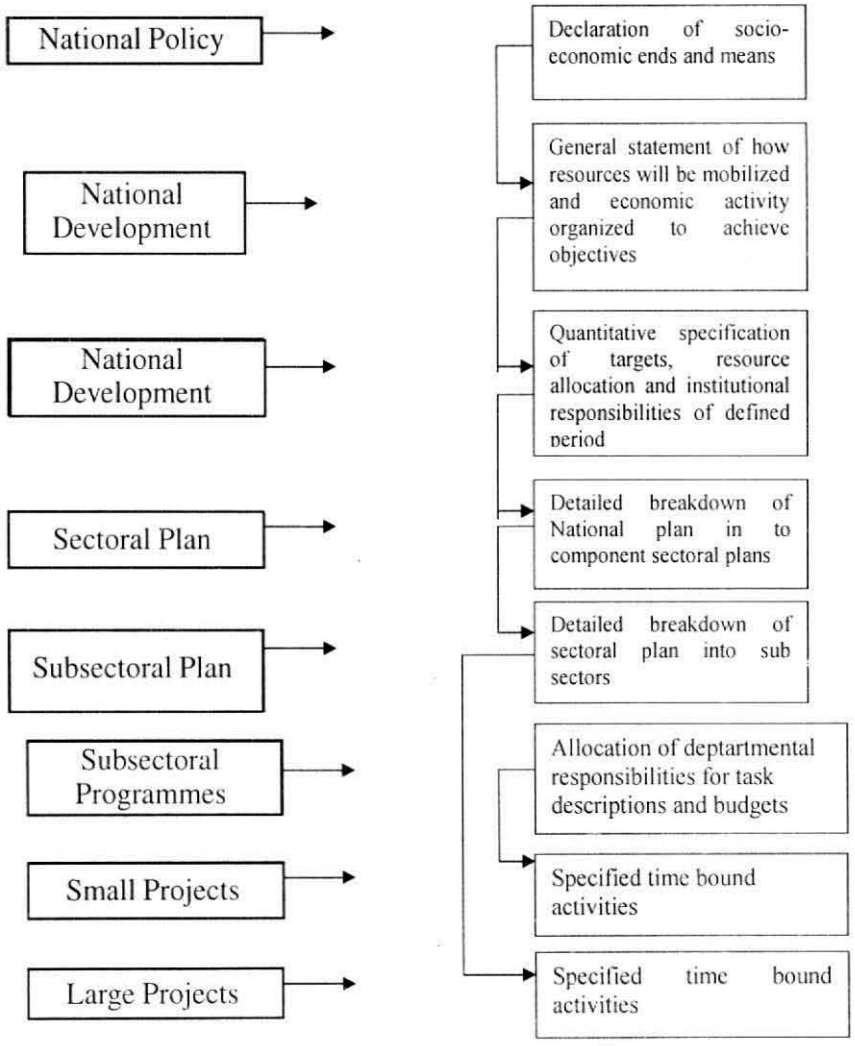


Fig 1 : Project Planning

CHAPTER 2

PROJECT CYCLE

Introduction

There is a natural sequence by which projects are planned and carried out and this sequence is called 'Project cycle'. International development agencies tend to use the World Bank methodology [Baum, 1982]. Under this scheme the cycle is broken down to six stages.

1) Identification or conception
2) Formulation or preparation
3) Appraisal or analysis
4) Implementation
5) Monitoring and control
6) Evaluation

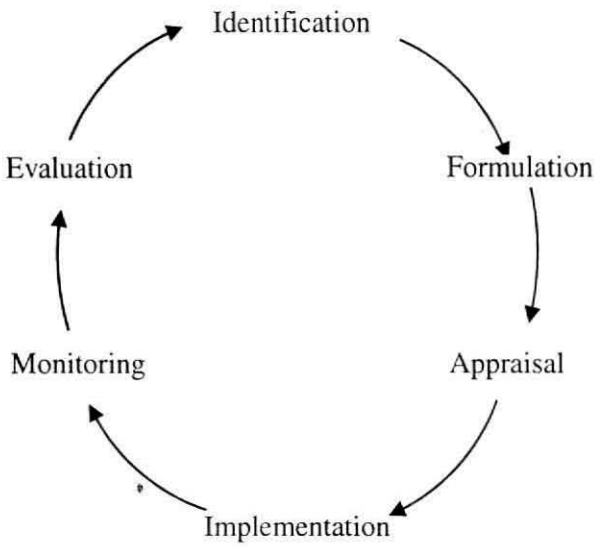


Fig. 2 : The Project Cycle

I. Conception or Identification of the projects

It is the first phase of the project cycle and here we find or identify potential or suitable projects. There can be many sources from which ideas may come for the identification of good projects.

a) Ideas for new projects can evolve from the present programmes.

b) Analysis of import and export trends may also brings in new ideas.

c) The most common will be well informed technical specialists and local leaders - as whileperforming their professional duties, technical specialists will have identified many areas where they feel new investment might be profitable.

d) A survey of the state or district to project the future needs over the next decade or so will also enable to identify potential projects.

e) By investigating local markets The quality or price of certain raw materials may lead to opportunities to produce competitively for export and /or domestic markets

f) By studying available Labour skills and management skills which have already been developed in the area, such as in processing agricultural outputs may suggest the possibility of producing other things requiring similar know how. For export possibilities, it will be useful to compare labour costs at different skill levels with the international market.

g) By making industry studies good opportunities may be found in expanding or diversifying already established processing methods. A thorough analysis of existing industries may lead to identifying logical new projects.

h) By review of old projects projects previously developed but not implemented often become feasible as markets increase or related industries change. It is often possible to find new opportunities in old ideas for which the economic circumstances have improved.

i) By observing experience elsewhere familiarity with current development in other countries or regions having somewhat similar environmental conditions may suggest possibilities.

After the generation of new ideas for a new project these ideas are screened with the assistance of subject matter specialists, experts, engineers, economists etc who have specialized knowledge of factors affecting the feasibility of projects in the various fishery sectors, the screening should be continued until the list of these new ideas for a good project is narrowed down to the most desirable possibilities.

In identification phase, it is also important to see whether the project is implemented in high priority areas and whether on prima-facie grounds the project is economically feasible. It is also imperative to identify problems and objectives of the projects and whether the government gives sanction for the project implementation or not.

The important stages in the process of identification are

a) Preliminary study
b) Pre-feasibility study
c) Feasibility

Preliminary study

In this stage, we assess whether the project proposed on the grounds of prima-fascia is feasible and the objectives of the project are achieved. On this ground, the preliminary study should embody the investment proposals, benefits extended from the project and method of implementation.

Pre-feasibility studies

Pre-feasibility study of project is used to present the framework within the project will operate and should take the form of a fisheries sector review. A full description of the project should be made stating its objective, how these accords with government planning objectives in the sector, how it relates to other fisheries, proposals and to the existing industry. An indication of its total costs in firms of both capital and operating costs and its net foreign exchange costs must be given.

Some discussion of the effects of the project on other sectors needs to be made, for example, its linkage effects on shipbuilding, port congestion; its need for new infrastructure development or increased marketing and processing inputs. The likely effect of the project on fish prices, exports, imports and domestic consumption of fish should be considered.

A summary of the major points to be covered in a pre-feasibility study a listed below

a) The economy and national status of fisheries.

b) Biological review (resource base, ecology, ocean conditions etc.)

c) Technical review (vessel, gear, infrastructure, posts etc.)

d) Processing, marketing and distribution (including market functionaries, indebtedness to traders, fish transport system)

e) Socio-economic review (human factors, manpower requisite, institutional arrangements)

f) Description of the projects (its status in fisheries sector and impact on the national economy).

g) Status of state fishing and marketing corporations, but also the functioning of co-operatives, banks and other services and an assessment through the ministry of finance and planning of the availability of foreign exchange for fisheries development.

Feasibility studies

In a full feasibility study a detailed analysis and assessment of a project is carried out to enable the levels of risks and rewards to be more fully quantified. This phase is of critical importance because it is the final analysis to be performed before the decision is taken to proceed with full-scale investment.

The study will contain full technical details of processes involved in the project and all assumptions underlying the anticipated markets, yield predictions, and cost estimates. To achieve this, available information of the site, water soil and infrastructure must be collected and assessed. Any gaps in the data must be exposed to establish if they are likely to undermine confidence in the technical assumptions. In a comprehensive study it may be possible to include comparisons with the performance of similar viable projects elsewhere. Factors to be considered in feasibility study include.

1. Environmental factors

a) Physical factors The two physical factors, which are fundamental elements in all aquaculture production systems and practices, are space and water. The two are considered together as it is the close association of space and water, which is of importance to aquaculture and also physical contents of water.

b) Chemical factors Two principle chemical factors are water productivity as a result of nutrient loading and the presence of toxic chemicals from pollution. The majority of impacts of chemical factors are negative in that they directly affect the health and survival of the aquatic animals being farmed through aquaculture. Positive impacts are also through increased productivity, which acts as sole food source.

c) Biological factors Two biological factors are the dynamics of animal and plant populations and individual health and survival.

i) Due to farming large number of individuals in one specific location – negative impact on wild population of important species through infection of farm diseases due to carnivorous nature of farmed species etc.

ii) There are negative impacts on aquaculture due to introduction and transfer of species – loss of genetic resources in native populations following inbreeding with farmed stocks.

2. Social factors

Social factors must be considered in the feasibility study otherwise it may lead to changes in social balances or social organization during project implementation. Social factors include legal, economic and cultural regimes of the society in which projects are required to function.

Legal regime At all levels of the aquaculture sector, the legal regime influences decision-making whether by public administrators or individual producers. There are specific issues of importance to aquaculture.

- Ownership or rights to the land, both inshore and offshore
- Ownership or rights to water
- Concern for environment

Economic regime Development of a project is influenced by the economic regime of the country, which may be either a market economy or a centrally planned economy. There are two specific economic issues of importance in aquaculture sector

- Ownership or equity in the farming operations
- Ownership of the live stock

Cultural regime In an aquaculture project specifically customs and behavior of individuals and communities with each other and their collective attitudes towards farming fish and consuming fish must be studied.

3. Demand factors

Profitability depends on the existence of consistent demand for the product.

a) Demand at local level

b) Demand at the regional and national levels

c) Demand at the international level.

4. Resource aspects

(Manpower, services, materials etc)

Recognition of resource constraints influencing the choice of an aquacultural project or fisheries project is frequently the difference between the success and failure in achieving objectives. For example, skilled manpower, availability of fertilizer may be constraints in private aquaculture farms, but not in government farms.

5. Financial aspects

The procedures and schedules for funds, manpower, supplies and equipment etc necessary to carryout project activities should be adequately organized and also project costs and additional costs should be calculated.

6. Political aspects

During project feasibility study should keep an eye on the political aspects like osition of the government, their future, their main activities, their interest in the project etc.

7. Technical aspects

Various technical aspects like standard of engineering design to construct new pond for aquacultural purpose or to modify the existing one, quality of feed, collection of disease free seeds studied.

In these stages we assess whether the project proposed on the grounds of prima-facie is feasible and the objectives of the project are achieved. On this ground, the preliminary study should embody the investment proposals, benefits extended from the projects and method of implementation. Assessment of the demand for the project's products, technical feasibility of the project reports. Import and export requirements, marketing aspects, and investment prospects etc should be exhaustively covered by the feasibility studies, including the analysis of sensitivity.

II. Formulation or preparation

The following points are considered while formulating the projects. The location of the project and project site must be based in technical analysis and technical feasibility of the project. The location of the project depends upon available physical resources, market conditions. Marketing facilities, alternative investment prospects, administrative experience, farmers objectives, technical skills, motivations, demand for products etc. Technical analysis must take into consideration all aspects of technology to be used in the project, and account for all inputs of goods and services. Assessment of suitability and adequacy of natural resources in advance based on the scientific investigations is also essential. Alternatives to the resource use are to be considered in formulation of the project. Due consideration is to be given to all the aspects such as technical, financial, commercial, managerial, organizational, social, economical etc. in the formulation of the projects. Identification of the missing links in the infrastructure system particularly in relation to adequacy of communication systems, markets and storage facilities is important.

Aspect of project preparation and analysis

According to RIPMAN, 1964, project preparation and analysis can be divided into six aspects

a) Technical aspects

b) Institutional-organizational-managerial aspects

c) Social aspects

d) Commercial aspects

e) Financial aspects

f) Economic aspects

a) Technical aspects

The technical analysis concerns the projects input (supplies) and outputs (production) of real goods and services. It is extremely important and the project framework must be defined clearly enough to permit the technical analysis will examine the possible technical relation in a proposed fisheries project; the soil in the region of the project and their potential for fisheries development,

the availability of ground water, the species variety, the production supplies or the vessels, gear and other infrastructure and also storage facilities etc. On the basis of these and similar considerations the technical analysis will determine the potential yields in the project area.

As the technical analysis proceeds, the project analyst must continue to make sure that the technical estimates and projections relate to realistic conditions and that farmers using the proposed technology on their own fields can realize the results of projects.

b) Institutional-Organizational-Managerial Aspects

The institutional, organizational and managerial aspects have an important role on projects have an important role on project implementation. The socio-cultural patterns and institutions of those the project will serve must be considered. Does the project design take into account the customs and culture of the farmers who will participate? Will the project involve disruption of the ways in which farmers are accustomed to working? If it does, what provisions are made to help them shift to new skills? By this way one group of questions ask whether the institutional setting of the project is appropriate.

To have a chance of being carried out, a project must relate properly to the institutional structure of the country and region. The project may incorporate local institutions and use them to further the project. How will the administrative organization of the project relate to existing agencies? Is there to be a separate project authority? What will be its links to the relevant operating ministers? Will there be institutional jealousies?

The organizational proposals should be examined to see that the project is manageable. Is the organizational such that lines of authority will be clear? Does the organizational design encourage delegation of authority, or do too many people report directly to the project Director? Are ample provisions included for managers and government supervisors to obtain up- to-date information on the progress of the project? Is a special monitoring group needed? What about training arrangement? Does the project have sufficient authority to keep its account in order and to make disbursements promptly?

Managerial issues are crucial to good project design and implementation. The analyst must examine the ability of available staff to judge whether they can administer such large-scale public sector activities as a complex water project, an extension service, or a credit agency. If such skills are scarce or absent, should this be reflected in a less complex project organization? In fisheries projects, the analyst will also want to consider the managerial skills of the farmers who will participate. If farmers with past experience limited to crop production are to become fish farmers, enough time must be allotted for them to gain their new skills. There must be extension agents who can help farmers learn to new skills and provision must be made for these agents in the organizational design and in the administrative costs of the project.

c) Social Aspects

Project analysts are also to examine carefully the broader social implications of proposed investments. We have noted proposals to include weight for income distribution in the formal analytical framework so that projects benefiting lower income groups will be favored .So it is the more important in the project design that explicit attention be paid to income distribution.

For social reasons, many governments want to emphasize growth in particular regions and want projects that can be implemented in this region. The project analyst will want to consider

carefully the adverse effects a project may have on particular groups in particular regions. In some areas the introduction of mechanical equipment has deprived women of work they needed to support their children. Will a proposed project have such an adverse effect on the income of working women and their families? Those designing or reviewing project will also want to consider the issue of adverse environmental impact and the quality of life that should be a part of any project design.

d) Commercial Aspects

The commercial aspects of a project include the arrangements for marketing the output produced by the project and the arrangements for the supply of inputs needed to build and operate the project.

On the output side, careful analysis of the proposed market for the project production is essential to ensure that there will be no effective demand at a remunerative price, where will the products be sold? Is the market large enough to absorb the new production without affecting the price? Is the project for domestic consumption or for export? What financing arrangements will be necessary to market the output?

On the input side, appropriate arrangements must be made for farmers to secure the supplies of quality seed, fertilizers etc. they need to adopt new technology. Do market channels for input exist, and do they have enough capacity to supply new inputs in time? What about financing for the suppliers of inputs and credit for the farmers to purchase these supplies? Commercial aspect of a project also includes arrangement for the procurement of equipment and supplies.

e) Financial Aspects

It deals with the financial effects of a proposed project on each of its various participants or individuals. A major objective of the financial analysis of farms is to judge how much farm families participating in the project will have to live on. The analyst will need budget projections that estimate year-by-year future gross receipts and expenditures, including the costs associated with production and the credit repayment farms families must take, to determine what remains to compensate the family for its own labour, management skills and capital. Financial analysis must judge whether the family will receive may be in food that is consumed directly in the households or the family realizes a considerable increase in income or " net incremental benefit " by participating in the project.

The analyst must judge whether farmers will need loans to finance on farm investment or to meet some production costs and whether seasonal short-term credit should be provided for working capital to finance inputs and pay for hired labour. The analysis farm income will also permit assessment of incentives for farmers to participate in the project what will be the probable change in farm income? Again what will be the effect of subsidy arrangements on farm income and what changes in government policy might affect the income earned by farmers? Will new subsidies be needed to provide sufficient incentive for the project to proceed?

An analysis of the financial aspect of the project administration will also be needed. It mainly covers the budget allocation, administrative costs, salary scales for projects personal and also replacement of equipment.

Finally, the fiscal impacts of some project will need to be considered. Will the increased output yield significant new tax revenues, perhaps from an export tax? If the administrative costs of project are not to be met from revenue, how will this affect the national budget in the future?

f) Economic Aspects

The economic aspects of project preparation and analysis require a determination of the likelihood that a proposed project will contribute significantly to the development of the total economy and that its contribution will be great enough to justify using the scarce resources it will need. The point of view taken in the economic analysis is that of the society as a whole.

In economic analysis taxes and subsidies are treated as transfer payments. The new income generated by a project includes any taxes the project can bear during production and any sales taxes buyers are willing to pay when they purchase the projects products. These taxes are transferred to the government, which acts on behalf of the society as a whole and are not treated as costs. Conversely, a government subsidy to the project is a cost to the society. Generally, in financial analysis taxes are usually treated as a cost and subsidy as a return.

In economic analysis, however, some market price may be changed so that they more accurately reflected social or economic values. These adjusted prices are called " shadow" or "accounting" price and in the analytical system recommended here are efficiency prices.

Again in economic analysis interest on capital is never separated and deducted from the gross return because it is a part of the total return to the capital available to the society as a whole and because it is that total return, including interest, that income analysis is design to estimate. In financial analysis, interest paid to external suppliers of money may be deducted to derive the benefit stream available to the owners of capital. But interest imputed or " paid" to the entity from whose point of view the financial analysis is being done is not treated as a cost because the interest is part of the total return to the equity capital contributed by the entity. Hence, it is a part of the financial return that entity receives.

Though, different method in economic analysis but many economists prefer analytical systems that explicitly include income distribution weights. They note that the system outlined here accepts in its formal structure the income distribution as it exist in a society and does not distinguish projects that have the most desirable effects on income distribution. Some economists take economic growth generated by investment, not income regardless of whether it is consumed or invested, as constituting at least part of their formal objectives.

III. Appraisal or analysis

Appraisal should take place before the implementation of the project. When a project is fully prepared it is appraised before being accepted as an investment suitable for borrowing. A team of independent experts appointed by government, the project sponsor, the funding agency, or the multilateral bank concerned undertakes appraisal.

The objective of appraisal is to check the thoroughness of the project by making a completely objective and independent study of the project as it has been presented, data have to be checked for reliability, consistency, the reasonableness of its projections, its accuracy in calculations and the validity of its assumptions. It is also necessary to examine the banking, administrative and commercial structures, which will be involved in project implementation and to ensure these have been properly conceived.

There are five criteria for appraisal of fisheries projects.

1. Technical review

2. Commercial review
3. Organization and Management review
4. Financial review
5. Economic review

It will also evaluate the project in terms of its effectiveness in meeting government objectives and development priorities. The project Appraisal Report is used as the basis for obtaining funding. The funding agency may subsequently ask for alterations, additions or even a reduction of he project. It may also impose some conditional terms and these may lead to protracted negotiations.

Once the loan has been approved, the funding agency may insist that certain guidelines be followed. Procurement procedures for the purchase of capital items for the project are laid down in the loan agreement and must be followed. In general the objectives are to procure items in the most efficient and commercial manner, usually this can be achieved most effectively by international competitive bidding which is open to qualified suppliers. However, to encourage local industry, some preference may be given to domestic suppliers and this may be most appropriate for items, which are too small for international tendering.

IV. Implementation

This is the most crucial phase of the project cycle. The secret of successful implementation depends upon the extent of realism put into the plans drawn before hand. It is often not uncommon, to notice our plans getting deviated from the reality. Here the role of prudent decisions by the personnel incharge of implementation to tackle the situation comes into play. Project implementation can be divided into three different periods viz. Investment period, developmental period and Full-production period. Investment period may range from few months to few years depending upon the nature of assets to be acquired. Assets proposed should be of superior quality. Development period too consumes time. Implementing agency should make all efforts to reduce the gestation period as per the plan envisaged in the beginning. Full production period is the time during which the beneficiaries start reaping the benefits of the project. Implementing agency should ensure that the beneficiaries do continue to receive benefits during the entire life span of the project.

V. Monitoring

Monitoring is the timely collection and analysis of data on the progress of a project, with the objective of identifying constraints, which impede successful implementation. This is highly desirable, particularly when projects fail, to be completed as per time schedule or in the process of attaining the set goals. It is imperative to get the feedback on the problems faced so that effective measures can be taken up to plug the deficiencies, which hamper the speedy implementation. Monitoring has to be done continuously to offset various shortcomings that crop up from time to time with regard to various aspects of implementation.

VI. Evaluation

This is last phase of the project cycle. It is not confined to the completed project. Evaluation can be done several times during the life of a project. In the evaluation process, it is important to see how far the objectives set out in the project are achieved. Deficiencies, snags or failures to achieve the objectives may be analysed and appropriate solutions to such failures answered. Evaluation process is to be completed in three phases. They are mid course evaluation, concurrent evaluation

and ex-post evaluation. In the first phase, evaluation is attempted before any change occurs in the existing situation. This is primarily meant to assess economic feasibility of the projects, since it is done at the very beginning. This type of analysis is otherwise called pre-project evaluation. Sometimes it is also important to take up evaluation when the project is in execution, and such evaluation is called concurrent evaluation. This type of evaluation is basically meant for identifying and analyzing the pitfalls in the execution of the project. Evaluation is also resorted to particularly when the project is completed in all its phases, in order to assess the achievement of ends or objectives set out by the projects. Such evaluation is called ex-post evaluation or end-evaluation. Evaluation is done by the agency other than the implementing one, like financing bank or sponsoring agency or government.

CHAPTER 3

IDENTIFICATION OF PROJECT COSTS AND BENEFITS

In fisheries projects, costs are easier to identify than benefits because the expenditure pattern is easily visualized. The various types of costs involved in the project are

- Project costs These include the value of the resources in maintaining and operating the projects for e.g. physical goods, land labour, debt service, taxes etc.
- Associated costs Costs that are incurred to produce immediate products and services of the projects for use or sale.
- Primary costs or direct costs These include costs incurred in construction, maintenance, and execution of the projects.
- Indirect costs or secondary costs value of goods and services incurred in providing indirect benefits from the projects such as houses, schools, hospitals etc.
- Real costs and nominal costs costs at current market prices are nominal costs, whereas if costs are deflated by general price index, these are termed as real costs.
- Social costs these are technological externalities and technological spill over accrued to the society due to the presence of projects i.e., pollution problems, health hazards, salinity conditions etc.
- Replacement costs Many aquacultural projects require investments that have different lifetimes. A good example is found in the case of water pumping scheme in which the earthworks and pump platforms may be expected to last ten to fifteen years but the pumps themselves may have a life of only five to six years. In preparing the analysis, allowance must be made for the replacement costs.

Next to identifying the costs, the estimation of benefits is imperative to ascertain the impact of the project. This is generally done by taking into account two situations i.e., 'with' and 'without' the projects. The difference is the net additional benefit arising out of the project.

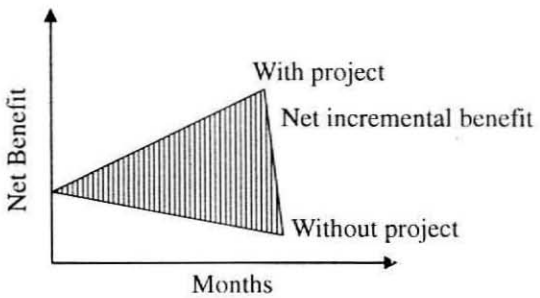


Fig.3 : With and Without Projects

Semi-intensive culture of shrimp

With project there was an increase in shrimp culture [Fig 3], but without project there as loss and output decreased, because of no control measures for diseases, and water parameters.

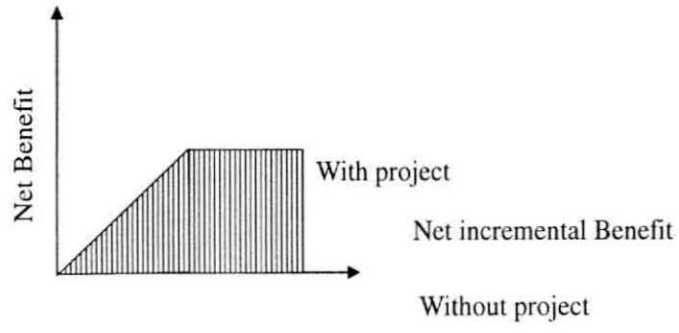


Fig. 4 : With and Without Projects

Intensive culture of sea bass

When there was a project and plan, output of sea bass was increased [Fig 4] and when there was no project because of highly carnivorous nature output was nil.

The above two examples show the increase in output with project, and decrease in without project.

Tangible benefits of projects

Tangible benefits of aqua projects can arise either from increased value of production or from reduced costs.

Increased production

Increased Physical production is the most common benefit of aqua projects. An irrigation projects permits better water control,so farmer can obtain higher yields. A credit project makes resources available for farmers to increase both their operating expenditure for current production,for fertilizers,seed or pesticides. The benefits increased the production from the pond. In large projects increased production wii be marketed through commercial channels.in that case identifying the benefit and finding a market price will probably not prove to difficult,although there may be a problem in determining the correct value to use in the economic analysis.

Quality improvement:

In some times the benefit from fisheries project may take the form of an improvement in the quality of product. For example analysis of live stock development projects in Ecuador which was to extend loans to producers of fish assumed that reaches would be able not only to increase their fish production, but also to improve the quality of their products, so that the average live price of steers per kg would be rise from s\5.20 to s\6.40 in corstant value terms over the 12 year development period.(s\=symbol of Ecuadorian sources)

Change in time of sale:

In some fisheries projects benefits will arise from improved marketing facility that allow the product to be sold when prices are more favourable.

Change in location of sale:

Some objects may include investment in trucks and other transport equipment to carry products from local area where prices are low to distant markets, where prices are higher.

Change in product from:

Projects involved in aqua processing industries expect benefits to arise from a change in

the form of the fish products. Farmers sell the fish to processing plants, which in turn change the shape of the products. The benefit to the processing plants arises from the change in form.

Cost reduction through mechanisation:

Canal water replaced bore water, and tractors replaced animals. Total production may not increase, but benefits arise because the cost has been trimmed.

Reduced transport costs:

Cost reduction is a common source of benefit wherever transport is a factor. Better feeder roads or highways may reduce the cost of moving produced from farm to the consumer.

Losses avoided:

In some projects the benefits may not arise from increased production but from a loss avoided. Some times a project increases output through avoiding losses, a kind of double classification, but one that in practice causes no problem.

Other kinds of tangible benefits:

Transport projects are very important for aquaculture development. This is for not only from cost reduction, but also from time saving and development activities in areas newly accessible to market.

Secondary costs and benefits:

Projects can lead to benefits created or costs incurred outside the project itself. Economic analysis must take account of these external or secondary costs and benefits, so they can be properly attributed to the project investment.

Incorporating secondary costs or benefits in project analysis can be viewed as an analytical device to account for the value added that arises outside the project, but is a result of the project investment. Evey item is valued either at its oppurtunity cost or willingness to pay greatly reduces the difficulty of dealing with secondary costs and benefits. There still remain many valuation problems related to goods and services not commonly traded in competitive markets. One way to avoided some of these problems is to treat a group of closely related investments as a single project.

It is some times suggested that project investment may give rise to secondary benefits through a multiplier effect. The concept of multiplier effect is generally thought of in connection with economics having excess capacity. It is also some times suggested that there is a consuption multiplier effect as project benefits received by consumers. Consumption multipliers are very difficult to identify and value. In any case they presumably would be much the same for alternative investments, so omitting them from a project analysis would not affect the relative ranking of projects.

Intangible costs and benefits:

Almost every aqua project has costs and benefits that are intangible. These are creation of new job opportunities, better nutrition as a result of improved water supply. Such intangible benefits are real and reflect true values. They do not however lend themelves to valuation.

In most intangible benefits arising from an aqua project, the cost are tangible enough; construction cost for aqua forms, supply of seed, feed and fertilizers and the like. Intangible costs arise for e. g. if new projects disrupt traditional patterns of family life, if development leads to increased pollution, if ecological balance is upset, or if intrinsic values are lost.

In every project, decisions will have to take intangible factors into account through a subjective evaluation, because intangible costs can be significant and because intangible benefits can make an important contribution to many of the objectives of rural development.

Part - II

Project Formulation

CHAPTER 4

FINANCIAL AND ECONOMIC ANALYSIS OF PROJECTS

Introduction

Financial aspects deal with the revenue earning consideration of a project. In financial analysis, particular emphasis is placed on the ability of the project to meet all operating costs and also to earn an adequate return on the funds invested. Here different criteria like the payback or cut off period, net present value, benefit cost ratio, internal rate of return, etc. are used to evaluate a project. Financial analysis is done with a view to estimate profitability, ignoring the benefits or costs to the society.

Economic analysis on the other hand takes a broader view. It does not limit itself to the investing donor agency, but extends its purview to include the country or region as a whole. It concentrates on determining the projects contribution to the development of the economy as a whole and justifying the use of scarce resources. It consists essentially of determining the priority sectors for investment in accordance with the social opportunity cost of capital and complying with social objectives.

Another aspect of economic analysis is the evaluation of secondary costs and benefits, which are those benefits and costs not directly associated with the project. For e.g. will it generate income and employment in other sectors, such as shipbuilding, fish processing, marketing; how will it affect other fisheries, what will its long-term effects be etc.

Economic and financial analysis, however, supplement each other. In view of budgetary constraints, demands for developmental and non-developmental funds in the public sector and inadequate capital formation, financial analysis of all projects become imperative. Even so, within the given budgetary constraints, if the objective of maximizing social welfare is to have precedence over that of making profits, selection of projects has to be done on the basis of social opportunity cost of capital rather than the expected financial return.

Underlying all financial and economic analysis is an assumption that prices reflect value so it is very important how to find these prices. In case of project analysis it is very essential to understand the following two terms;

- Marginal value product
- Opportunity cost

1. Marginal value product The marginal value product is the extra revenue that comes from increasing the quantity of input used by one unit, all other quantities remaining constant.

For example,

Table 1: Marginal value product of output.

Urea (kg/ha)	Yield (kg/ha)	Value (Rs.)	Marginal value product (Rs.)
0	200	2000	-
10	220	2200	20
20	225	2250	5
30	230	2300	5
40	232	2320	2

Sale of fish @ 10 Rs./kg

Urea @ 5 Rs./kg

So marginal value product is

$$\frac{2200 - 2000}{10} = 20$$

So, if a fish farmer buys urea @5 Rs. / kg and uses it to increase output by 20 Rs, he would be applying more urea, but as the intensity of application increase, each additional kg of urea has less and less effect on production.

If he increases the application from 30-40 kg/ha, then increase in the value of production is just Rs. 20 and marginal value product is Rs 2. Since he is purchasing urea @ 5 Rs./ kg, it is not possible for fish farmer to apply urea at this rate.

So fish farmer should expand the application of urea until he reduces the marginal value product of the urea to its market price. The optimal amount of urea to used will also change, when the price of urea change relative to price of fish.

2. Opportunity cost In simple language, the opportunity cost is the return that can be from a resource when it is used in its next best alternative.

Table 2: Opportunity cost of input and output.

Urea (kg/ha)	Yield (kg/ha)	Value (Rs.)	Marginal value product (Rs.)
0	100	1000	-
10	120	1200	20
20	130	1300	10
30	135	1350	5
40	137	1370	2

Urea purchased @ 5 Rs./Kg

Prawn sale @ 10 Rs./ Kg

If the farmer also wants to have prawn culture practice, but has limited resources, he is unable to increase the application of fertilizers for both fish culture practice and prawn culture at the same time.

In that case suppose he is applying fertilizers, i.e., urea in fish culture ponds at the level where marginal value product is just equal to its market price and if he shifted 10 Kg of fertilizer to prawn culture ponds, then he would have reduced the value of fish production from Rs. 2300 to Rs. 2250, but while doing this he could have obtained prawn production of Rs. 200 and marginal value product of Rs. 20.

Finding market prices

The market price is the best alternative to estimate of its marginal value product and of its opportunity cost and in most cases the market prices is the best prices to use in valuing either cost or benefits. So first step in valuing cost and benefits are to find out the market prices for the inputs and outputs.

Determining market prices

1. Point of first sale and farm gate prices In project analysis, a good rule for eterming a market price for aquacultural commodities produced in the project is to seek the rices at the point of first sale and if the point of first sale is relatively competitive market, then the price at which the commodity is sold in this market is probably a relatively good estimate of its value in economic as well as financial terms.

For many aquacultural projects in which the objective is to increase production of commodity, the best point of first sale to use is the boundary of farm that is farm-gate prices. The increase in value of the product when it is processed and delivered to market arises as a payment for marketing services. Thus this value is not added properly attributed to the investment to produce the commodity, rather it arises from the labour and capital engaged in the marketing services. The farm gate prices are the best prices at which to value home consumed products.

2. Pricing intermediate goods An intermediate goods is an items produced primarily as an input in the production of another good. If an intermediate good is not freely traded in a competitive market we cannot expect to obtain a price established by a range of competitive transaction.

For example- fodder produced on a farm and then fed to dairy animals. So the analyst would treat the whole farm as a unit and value the milk produced at its point of first sale. The treatment of intermediate products will vary from project to project depending on the particular marketing structure.

So to avoid most of the problems that might be introduced by trying to impute value for intermediate goods, financial accounts in agricultural project are based on budgets for the whole farm instead of a budget for individual activity on a farm.

3. Other problems in finding market prices It is very difficult to determine the value for two important inputs in agricultural project that is land and labour. This happen primarily when analysis moves from financial analysis to economic analysis of a project. In financial analysis the treatment of prices for land and labour is quite straight that is prices used is the prices actually paid.

Predicting future prices

Since project analysis is judging future returns from future investment, as analysts we are immediately involved in judging just what future prices may be. So this is a matter of judgment,

since no mathematical models exist, the only consolation is that careful, considered judgment about the course of future prices better than giving the matter no thought at all and wasting scarce resource on incompletely planned project.

The best initial guess about future prices is that they will retain the present relationship, or perhaps the average relationship they have borne to each other over the past few years.

1. Change in the relative prices

In financial analysis, change in the relative price means a change in the market price structure that producers face either for inputs or for outputs.

For example, a rise in the relative price of fertilizers reduces the incremental net benefits. A change in the relative price of an item implies a change in its marginal productivity that is a change in the marginal value product, or a change in the satisfaction it gives when consumed.

In economic analysis where maximizing national income is objective, a change in the relative price of input implies a change in the amount that must be forgone by using the items in the project instead of elsewhere in the economy. So the changes in the relative price have a real effect on the project objective and must be reflected in project account in the years when such changes are expected.

2. Inflation

The approach most often taken into consideration in project analysis is that current prices level or same future prices level will continue to vary. So when we consider the measure of project worth, some means of deflecting future prices must be adopted for comparing future cost and benefits streams in terms that are free from the effect of general price increase.

Objectives of financial analysis

1. Assessment of financial impact It is most important to assess the financial effects the project will have on farmers, public, private firms, government perating agencies and any other who may be participating in it . The assessment is based on an analysis of each participant's current financial status and on a projection of his future financial performance as the project is implemented.

2. Judgment of efficient resources use The overall return of the project and repayment of loans extended to individual enterprises are the important indicators of efficiency of resources used.

3. Assessment of incentives It is very important to assess the incentives for farmers, of managers and owner's who will participate in the project. Will farm families have incremental income large enough to compensate them for the additional efforts and risk they will incur?

For semipublic enterprises, will the return be sufficient for the enterprises to maintain self-sufficiency or self-financing capabilities and to meet the financial objectives set out by the societies.

4 Provision of a sound financial plan The principal object of financial analysis is to work out a plan that projects the financial situation and sources of funds of the various projects participants and of the project itself. The financial plan provides a basis for determining the amount and timing of investment by farmers and for setting repayment terms & conditions for the credit extended to support the investment. It also provides the same basis for an assessment of the investment plan and debt repayment capacity of the private and public firms participating in the project.

5. Co-ordination of financial contribution The co-ordination is made on the basis of an overall financial projection for the project as a whole .It addresses itself to such question as whether the availability of resources from the treasury or international agency is matched with the farmers.

Investment capacity and available funds for investment and operating expenses as well as with the timing of expenditure for project investment such as feeder channel & working capital needed for stocks in processing industries.

6. Assessment of financial management competence On the projection of the latter financial accounts, especially for the larger firms and project entities. The analyst can form a judgment about the complexity of the financial management the project will require and about the capabilities of those who will manage the project's implementation.

From this assessment, the analyst can judge what changes in organization and management may be necessary if the project is to processed on schedule and what specialized training may be advisable.

Financial ratios

These ratios enable us make judgments about efficiency of the enterprise, its return on key aggregates and its credit worthiness. These ratios are discussed in detail in later chapters.

Recovery of cost

When government invests in a project that increases the income of the farmer, the question arises that how much of the government expenditure should be recovered from the project beneficiaries There are two main issue to be considered while formulating the cost recovery policies.

1. Proportion of cost expanded on a project should be recovered rapidly.
2. Proportion of the benefit received by individual to be recovered through direct charges and such indirect means increase the tax revenues.

Objectives of cost recovery

These are as follows

1. Economic efficiency This objective is concerned with level and structure of the prices to be charged e.g., in irrigation projects, the price of water. The objective is to minimize waste and allocate water optimally to maximize the net benefit from the project to the economy.

The best way to do this would be through a price that would be equal to the contribution it would make to increase the output that is called 'efficiency price' but it is rare. It is even possible to charge farmers. On optimal economic prices, this might not be compatible with objectives of income distribution and public savings and investment. Hence other criteria for accessing charges will have to be considered to ensure an equitable income effect from the project cost by charges that prospective beneficiaries can afford to pay and that still leave them adequate incentives to participate them. Some recovery of benefits and cost will usually come from existing general taxes such as export taxes and income taxes.

2. Income distribution The second objective is to collect charges equitably and in line with national policy for income distribution. It may be desired to charge small farmers proportionately less than large farmers in the same project. Thus specific taxes are designed to capture part of benefit a of a project should be taken in to account difference in income level and in the ability of beneficiaries to pay so all the taxes will have to be set taking in to account disincentives, tax evasion and cost collection.

3. Public saving Most of the governments in developing countries are short of funds. Consequently it may be desirable for governments to collect more resources that would be generated solely from efficiency pricing (which, in any case. Is generally impractical) or from recovering only

the cost of project and no part of net benefit. So by this, projects should be financially self supporting and this would also enable the government to undertake additional rural development.

Measuring cost and rent recovery

1. Cost recovery index gives the idea of what proportion of public expenditure on a project will be recovered directly from the beneficiaries and through taxes collected off the farm.

$$\text{Cost recovery index} = \frac{\text{Present worth of incremental water charges} + \text{Present worth of incremental benefit taxes}}{\text{Present worth of incremental public sector outlay}}$$

2. Rent recovery index Which gives idea of what proportion of the total benefit will be recovered from project beneficiaries and from other sources

$$\text{Rent recovery index} = \frac{\text{Incremental revenue from water sale} + \text{Incremental benefit taxes}}{\text{Incremental economic rent accruing to project beneficiaries}}$$

Economic aspects of project analysis

Once financial prices for cost and benefits have been determined and entered into project, the analyst estimates the economic value of a project to the nation as a whole. The financial prices are the starting point for the economic analysis; they are adjusted as needed to reflect the value to the society as a whole of both the inputs and outputs of the project.

For the purpose of project analysis, we took the objective of a firm to be to maximize the farm family's incremental net benefit, net income of firm, and objective of society to maximize the contribution of a project makes to the national income – the value of all final goods and services produced in the country during a particular period. Net national income is valued in opportunity cost that is the value of goods and services in its next best alternative use. When market price of any good or service is changed to make it more closely represent the opportunity to the society, the new value assigned becomes the shadow price (accounting price).

In economic analysis, we are taking the firm's contribution to the nation and it may be tangible benefit that means it can be measured and intangible benefit that means that cannot be measured. Firms do not contribute directly to national (tangibly), so we have to adjust financial prices of tangible items to reflect economic value.

CHAPTER 5

EVALUATION OF INVESTMENT FEASIBILITY AND CRITERIA FOR SELECTION OF FISHERIES PROJECTS

Introduction

In order to as certain whether an aquaculture investment project is feasible or not, a cooperative evaluation should first be conducted by both the biologist and economist. Only those species and projects that are suited to the local environment and are biologically feasible for development should be considered. Thereafter, a socioeconomic study can be undertaken. Basically, an economic evaluation includes both the production and marketing functions.

1. The first requirement for any aquaculture investment project in both the public and private sectors is the availability of suitable land and water resources.

2. The species selected for development should be adapted to the local environmental conditions and the stocking materials and suitable feed should be readily available at reasonable cost. The species should also be fast growing and culture technology should be locally available.

3. There should be no legal constraints on development (this is particularly important for private investors).

4. The products of the investment project should have a high market demand with a reasonable price.

5. The investment project should be financially lucrative compared to other investment opportunities for private investors and should also be socio-economically feasible with alternative means of achieving the national objectives for public investment. Private investors usually use profitability as a measure of financial feasibility when assessing commercial aquaculture projects, and public officials usually consider socioeconomic benefit-cost and/or the social internal rate of return as measures of economic feasibility along with some qualitative judgments.

In order to evaluate the feasibility of an investment protect in aquaculture, one must consider six criteria

- Resource availability,
- Environmental suitability,
- Biological feasibility,
- Market potential,
- Economic feasibility, and
- Institutional feasibility,

6. It is also important to realize that many variables ought to be considered for each criterion. Each variable can be assessed as favourable, partially favourable, unfavourable, etc. Each ranking can then be scored (or coded) numerically-weighted or unweighted. Next, a general score or code can be assigned to each criterion after evaluation of all the subscores and codes, and the bio-economic feasibility can be determined by weighting the general score or code for each criterion. This procedure can be varied to suit particular projects.

Table 3 : Summary Sheet for Feasibility Evaluation

Criteria	Variables	Rank of Suitability	Score or Code
Resources	Suitable land area	a. Available for expansion b. Limited for expansion c. Not available for expansion Sub-score or code	--------
	Value of suitable land	a. Low b. Average. c. High Sub-score or code	--------
	Water supply of suitable quality	a. Adequate year round. c. Seasonal shortage c. Not available Sub-score or code	--------
General score or code for resource availability			--------
Environmental suitability	Water temperature	a. Well suited b. Suited after temperature is manipulated during certain periods of the year c. Not suited d. Sub-score or code	--------
	Salinity	a. Well suited b. Suited after salinity manipulation c. Not suited d. Sub-score or code	--------
	pH value	a. Well suited b. Suited after pH value is manipulated c. Not suited d. Sub-score or code	--------
	Tidal flushing	a. Well suited b. Suited after tidal manipulation c. Not suited d. Sub-score or code	--------
General score or code for resource availability			--------
Biological factors	Breeding	a. No breeding problem, spawning in captivity, fry available from hatchery. b. Supply of fry relies on captured wild gravid females, or on the	

		catch from native waters, but availability of fry is not limited at present. c. Availability of fry from natural waters is limited but the breeding problem is expected to be solved in the near future. d. Availability of fry from natural waters is limited and the breeding problem is not expected to be solved in the near future Sub-score or code	--------
Feeding		a. Nutritional requirements of different age stages are known and appropriate feeds (artificial or natural) are available at reasonable cost b. Nutritional requirements are partially known. c. Nutritional requirements are not known d. Sub-score or code	--------
Crowding		a. Adapted to crowding conditions with no major problems in diseases and parasites, and/or with vide range of oxygen tolerance. b. Some problems with disease and parasites under crowded conditions, or with narrow range of oxygen tolerance c. Not suited for crowding conditions d. Sub-score or code	--------
Growing period		a. Less than one year b. One to two years c. More than two years d. Sub-score or code	--------
General score or code for resource availability			--------
Market potential	Price elasticity	a. Elastic demand with ready market b. In elastic demand but elasticity can be improved by market promotion and product development c. In elastic demand with limited market d. Sub-score or code	--------
	Income elasticity	a. Elastic demand b. Unitary elasticity c. Inelastic demand Sub-score or code	----------
	Competition	a. No competition b. Competes favorably in price with close substitutes c. Competes unfavorably with close substitutes at the present but favorably in the future	

		d. Cannot compete with close substitutes Sub-score or code	--------
Culture, religion and tradition		a. Species is currently cultured and preferred by majority of population without socio-cultural limitation b. Species is accepted by a part of the population due to socio-cultural limitations. c. Species is not accepted due to religion or tradition d. Sub-score or code	--------
General score or code for resource availability			--------
Economic feasibility Profitability		a. High rate of return compared with alternatives. b. Average rate of return compared with alternatives. c. Low rate of return compared with alternatives. Sub-score or code	--------
Socio-economic feasibility		a. Average cost per unit of protein,or protein yield per unit of land is favorable compared with alternatives if the national policy concerns animal protein deficiency. b. Foreign exchange earnings per unit of land or other scarce resources are favorable compared with other alternatives if national policy concerns foreign exchange earnings. c. Employment per unit of land is favorable compared with agriculture activities if national policy concerns employment in rural areas. d. Combination of all the above-mentioned conditions or any two of them is favorable compared with alternatives. e. Partially favorable compared with alternatives. f. Unfavorable compared with alternatives. Sub-score or code	--------
General score or code for institutional criteria			--------
Institutional feasibility	Permit	a. Easy to get permit. b. Difficult to get permit.	
	Conflicts in use	a. No conflict b. Some conflict c. Strong conflict	
	Use rights	a. With legal use right b. Without legal use right Sub-score or code	--------

Criteria for selection of fishery projects

The important criteria for the selection of fisheries project are briefly summarized below.

1) Work selection criteria

This relates to immediate needs of the project area and has a direct or indirect relation in increasing prospects of fisheries production, income and employment.

2) Priority criteria

Here it deals with whether the project implemented falls under priority area or not.

3) Social criterion

It considers the direct employment prospects, ecological balances, externalities, pollution etc.

4) Financial criteria

According to this criterion it is determine whether the required amount of capital is supplied or not for the implementation of the project. In case the execution is delayed, additional capital requirements are to be assessed.

5) Supply criterion

This is concerned with available resources like physical inputs, labour availability and other resource endowment. Supply of skilled labourers and un-skilled labourers and technical personnel are to be evaluated for the completion of the project on time.

6) Implementation criterion

This is based on organizational and management abilities of technical personnel. Organization refers to the organization hierarchy of the implementing agency. The availability of staff at various cadres, demarcation of authority and linking of authority and responsibility etc are to be analyzed in detail.

7) Project benefits criterion

Both tangible and intangible benefits must be correctly assessed and evaluated. In this process the benefits accrued due to forward linkages and backward linkages need to be given specific weightage. The benefit must address community defined priority needs in the areas of health, education, training and income generation.

Choosing between alternative when benefits are valued

Where the benefits of a project and project alternatives can be valued, they can be aggregated and compared with the costs of the project or project alternatives. Three criteria are commonly used to aggregate and compare costs and benefits. However, they cannot all be used in the same way to choose from project alternatives.

The benefit-cost ratio compares the present value of the benefit streams, each discounted at the same rate. The comparison is made by forming the ratio of the present value of benefits to the present value of costs. However, the benefit-cost ratio should not be used for choosing from alternatives as the ratio is sensitive to the way in which benefits and costs are grouped, for example, whether residual values are subtracted from the cost streams or added to the benefit streams.

The net present value (NPV) also compares the present value of the cost streams with the present value of the benefit streams. However, it does so not as a ratio but by taking the cost stream away from the benefit stream to obtain the net benefit stream, which can then be discounted. In choosing between project alternatives, the alternatives can be ranked according to their NPVs, which at economic prices represent value of net output that will be generated in the economy over the life of the project. The economic net present value (ENPV) is calculated for each project alternative using the Bank discount rate of 10 to 12 percent.

The third criterion for summarizing the benefit and cost effects of a project alternative is the internal rate of return (IRR). The IRR represents the rate of return in economic prices that would be achieved on all expenditures of the project. The EIRR is calculated using the net benefit stream obtained by subtracting year by year all costs from all benefits. The EIRR is the rate of discount for which the present value of the net benefit stream becomes zero. Put another way, it is the rate of discount at which the present value of the cost stream is equal to the present value of the benefit stream.

The ranking of project alternatives according to these three criteria may differ. The overriding purpose of the economic analysis of projects is to increase the net output measured at economic prices in the national economy. The ENPV criterion measures this directly. The choice between project alternatives should be made using the ENPV criterion at the chosen rate of discount, between 10 and 12 percent.

Choosing between alternative when benefits are not valued

Where the benefits of a project cannot be valued, they cannot be aggregated with the costs of the project. In these circumstances, a decision can be made only about which option has the lowest present value of costs for providing a given level of output. If the full costs of each alternative are laid out over the full life of the project, including any residual value at the end of the project life, then for each alternative the present value of costs can be calculated using the chosen discount rate between 10 and 12 percent. The best alternative is the option with the lowest present value of economic costs.

The choice between cost alternatives can also be approached another way. The discount rate that equalizes the costs of different options compared in pairs the equalizing discount rate can be calculated. Comparison of the equalizing discount rate with the Bank's discount rate for decision-making purposes will identify the least cost option between successive pairs of options.

Where the cost alternatives do not provide exactly the same level of output, or where different cost alternatives have multiple and differing outcomes, it is difficult to identify the option with lowest present value of costs without placing weights on the outcomes from the different alternatives. In these cases, the approach has to be adjusted to consider both the target level of attainment of different outcomes that is desired, and the extra costs of the different alternatives higher levels for the outcomes.

Five instances of mutually exclusive alternatives

1. The most general case is where we have entirely different alternative projects that are mutually exclusive-example, a carp hatchery or a fresh water prawn farm.
2. The scale of a project is a variation of mutually exclusive alternatives, viewing a large project as a mutually exclusive alternative to a small version of the same project.
   Example constructing a small jetty is mutually exclusive to constructing a fishing harbour at the same site.
3. Another instance is the special case of timing whether it would be better to begin a project now or later. In effect, postponing a project is mutually exclusive alternative to undertaking it immediately.
4. Yet another special case involves the choice of alternative technology. Example, semi tensive and intensive shrimp farming.
5. The final case is that of additional purpose. Example – a shrimp farm with an effluent treatment pond used as an aquaculture medium is a mutually exclusive alternative to the same project that does not use the effluent pond for culture.

Reasons for project analysis proving wrong

When a fisheries project analysis proves to be a poor predictor of the actual outcome of a

project, it may be that the project design or implementation is at fault, or it may be that the project analyst has done a poor job of incorporating a good project design in an analytical framework.

The most common reason for fisheries projects run into problems of implementation may be grouped into six major categories

- Poor project design and implementation
- Inappropriate technology
- Inadequate support system and infrastructure
- Failure to appreciate the social environment
- Administrative problems include those of the project itself and of the overall administration with in the country.
- The policy environment of which the most important aspect is producer price policy.

1) Poor project design and complementation

The fisheries project when it doesn't take into account, the right appraisal techniques, delay in implementation, lack of proper monitoring and control the project performance may be futile with no worth while results. The project design should include a proper fool proof design accounting for the different risks and uncertainties which can interfere with the project returns.

2) Inappropriate technology

Given the use and availability of land in most developing countries, increased crop production generally must depend on greater crop yields rather than on area extension. Thus improved technology is a key element in most agro/fisheries projects. For any technology, the major success factors appears to have bean the appropriateness of the technology proposed for the given local conditions, the complimentarily of recommended inputs, and the strength of the support systems (including research and extension to adopt the offered technologies to suit changing circumstances.)

3) Infrastructure and support systems

The project should provide an essential chain of support systems and infrastructure.The links in the chain include the relevant research, extension services, credit availability, input supply and product markets; the importance of the chairs lies in the introduction of technical packages. These packages must first be developed and tested through research adapted to the ecological conditions found in the project, and then delivered to the formers through an adequately staffed, qualified and motivated extension service that can then provide feed lack for further research.

In most cases, farmers don't have sufficient funds to purchase the recommended packages, and credit has to be made available. The input supply has to be organized and this includes introduction of improved high-yielding varieties, provision of better livestock breeds and the strategic location of stores where fertilizers, pesticides, and machinery such as pumps and their spare parts are available. Finally, the marketing of farm produce has to be organized in a manner that provides sufficient incentives to producers and avoids costly losses.

A major problem in agriculture and rural development projects is organizing farmers efficiently to provide than services especially in their adapting new technology. The appropriate asuarinas of farmers into self-help schemes is especially difficult and the record of cooperatives has not been good. There is no easy solution to these problems. A critical factor is to recognize at the project design stage that the small farmer will not take risks that could involve losing his livelihood and that some form of organizing farmers into self help groups is essential to economical provision of government service. So, here extension service plays a very important role.

4) Failure to appreciate the social environment

Sometimes the technical aspects of a project maybe fairly well foreseen, but the social affects inadequately assessed. A study revealed that in some areas women produced fish but that the

credit needed for new inputs was channeled through institutions of which only men were members. When the rational credit agency setup credit channels that could lend directly to women, implementation accelerated markedly.

In another African project in an area of traditional extended family groupings a limit was established on individual loans for crop intensification. As a result instead of the head of the family, who was responsible for allocating land to be cultivated, being able to borrow on behalf of the whole family individual cultivators had to seek credit. Borrowing directly for production on their own account has the cultivators a new, independent income. The impact of this change-whether good or bad on the social structure of the area was not even considered by the analyst when the project was formulated (Olivares 1978)

5) Administrative problems

In efficiency in the administrative level will result in failure of the projects should improve the effectiveness of implementation and proper monitoring. Staffing is a major problem in almost all development projects. Difficulties can be institutional-for example, restriction governmental salary polices, civil service procedures, and promotion regulations –or can take the form of shortage of certain kinds of skilled people. One solution is often the use of consultants. Yet there frequently are difficulties between local project personnel and external consultants. Other common personnel problems include incompetent staff, ineffective training, high turnover and poor matching of specific individuals with specific jobs.

Delays in procurement will result in shortages of material, especially of foreign equipment. Sometimes delay is due to inadequate foresight and forward planning and sometimes (particularly in rural development project) to unfamiliarity with procurement practices. The importance of timely procurement must be emphasized from the first stages of the project cycle and should be prominently included in the detailed implementation schedules

Government administrative and managerial practices are at least as important to project implementation as the skills of project managers. If the central or local administrative processes are inadequate, the projects will encounter delays and almost always, consequent cost increases. Common problems include slow and cumbersome decision making poor systems to authorize disbursement of project funds, ill-defined organizational arrangements, inadequate coordination among different agencies involved with a project and sometimes government structures that deny appropriate authority to the project manager.

6) Policy environment

Every project must be implemented within a framework of polices set by the government. If these are such that farmer's incentives are destroyed or other serious implements are put in the way of project implementation, then the project cannot be expected to achieve satisfactory results.

The overriding importance of producer prices in affecting producer income, production levels and economic efficiency was confirmed when analysed some projects. Prices contributed to expansion of production by encouraging farmers to participate in the project to expand areas devoted to the project crops and to use more inputs and thereby increase yields.

CHAPTER 6

GUIDELINES FOR PROJECT PREPARATION REPORTS

Introduction

These general guidelines will give an idea about the scope and content of a preparation or appraisal report for an aquaculture or rural development project. Most projects in aquaculture are adaptable to a fairly standard form of presentation. It gives the starting point i.e. the format. It will give the readers of the report a narrative with supporting tables and annexes that gives information and conclusion about the worth of the proposed project without confounding them with unnecessary or extraneous detail.

These guidelines emerge from the combined experience of the food and agricultural asuarinas, the World Bank and other international lending institutions. The Inter American bank has prepared a comprehensive set of outlines for many different kinds of aquacultural projects. Different elements of a project will need different emphasis depending on the kind of a project.

As far as possible the main text should present the project in a form that a non specialist can understand specialized backup information-including maps,charts, and detailed tables should be reserved for the annexes or the project file.

The principal elements of project preparation or appraisal report are outlined in the following way. It can include the origin of the project concept in the national development plan in a sector survey or by a project identification mission. It might mention the government agencies and other asuarinasn involved in the preparation and any external assistance received. It can acknowledge the team that prepared the project and the report and can mention the period in which they work.

Background

A well thought-out and properly constructed background discussion can do much towards establishing the framework of the project and making it intelligible in a broader economic and social perspective. The analyst needs to be very discriminating when choosing material for this part. The only general guidance is that there should be a clear relation between this material and the contents of other sections of the report.

(a) Current economic situation;

This discussion could mention per capita income dependent on particular moments of imports and exports, balance of payments considerations and the like. It should cover only those features of recent economic developments that have a bearing on the project and on studies of the possible alternatives to the project.

(b) Status of the fisheries sector;

This describes the main characteristics of the fisheries sector of the country including constraints for over all development and a description of relevant sub sector.

(c) Development and social objectives;

This section might outline development and social objectives as expressed in national plans and official policy statements it could note the main elements of the national strategy for aqua cultural development and mention significant government policies including price and interest rate subsidies supply of inputs, targets for rural income regional balance and the like.

(d) Income distribution and poverty;

If a project is designed to benefit a particular group of the rural people, a discussion of income distribution and poverty should be appropriate. In the background section, the information should establish a framework for the eventual justification for selecting a particular region or line of action for priority attention under the project. It should cover information about income distribution on a natural basis and give a regional or social dimension to the data.

(e) Institutions related to fisheries developments

Concerned with the development and financing in the fisheries sector covered by the project. These might include the Ministry of Agriculture, the live stock development authority, NABARD etc.

Project rationale

Against the fully discussed background of development opportunities and constraints with in the relevant sectors, it should also explain why a particular development strategy has been decided for this project and establish the technical, social, and economic reasons for the selection of this particular project in preference to possible alternatives. This may be the best point at which to indicate the scale of the proposed project and to explain why a certain size has been chosen. Finally there should be a project risks and the steps that have been taken in project implementation to minimize them.

Project area

It is to present a description of the existing status of the area, where the project will be located and to give the basis from which the project starts. These descriptive data should be presented in the relevant physical, aqua cultural, social, economic, institutional and legal terms.

A. Physical features

This section will deal with the main geographical and topographical features of the area and relate the area to important features of the country as a whole The principal objective is to show that the climate and soils are suitable for the culture and live stock production proposed.

(a) Geographic location

General location of the project area with in the country is identified and then the area is defined more precisely in relation to administrative boundaries.

(b) Climate

Should cover, rainfall, including monthly and annual total, intensity and variability, temperature, humidity, evaporation, transpiration, etc, For dry land culture the amount of water and rainfall timely is needed this is also taken into consideration.

c) Geology soils and topography

Here take into consideration land in the project its aqua cultural potential, its sustainability for culture, its need for drainage etc. Judgment will be required about the scale of the maps and land classification to be included in the report.

(d) Water resources

Surface and underground water resources should be described to the extent they are relevant to project decisions. Usually this is done from the viewpoint of culture and drainage.

B. Economic base

This section should cover the main economic features of the project region

(a) Aquaculture and live stock resources

The importance of this sector is the economy of the region, the proportion of people employed in these activities, the area and an approximate estimate of the value of these products may be given

1. Land use, farming systems and cultures

Include information about land type, farm size, culture type species varieties brooders, and inputs used. A short description of aqua cultural practices and results achieved on experimental stations in the area may be mentioned.

I) Input supply and product marketing

This gives about channels for the supply of inputs and of the facilities for marketing from production. The effects of such government policies as price supports, input subsidies, taxes on products and the like may be described and evaluated.

2. Other economic activities

These include for e.g. forestry, fishing rural handicrafts and processing industries, number of families engaged in these should be given for estimation of rural economy.

(a) Land tenure and size of holdings

Land tenure should be discussed with reference to the proportion of owner cultivator, tenant cultivators and landless labourers. If possible the size of holding may be related to the kind of tenure. The descriptions should refer to any changes in land tenure caused by aquaculture reform and settlement.

(b) Population and migration

Data that illustrate aspects of population as density per square kilometer, pressure of population on the cultivated area, dependency ratios and the literacy rate, migration into urban and rural and seasonal flows may be described and quantified, A discussion of employment and underemployment in the project area or near by seasonal and its relevant. Income levels discussed in the project area.

3. Social services

Social services like primary and secondary schools, dispensaries and other facilities. Disease problems their control are discussed and social services that function well and those that may need improvement are mentioned.

4. Infrastructure

Depending on the project itself, infrastructure related components and requirements differ. Some projects are concerned exclusively with providing rural infrastructure in which case of course, the weight given to this section would be substantial. It may be relevant to quantify the length of road, annual tonnage; recent growth in traffic etc. infrastructure of project output and to the supply of inputs should be mentioned. The number of families served by various infrastructure facilities may be quantified.

Organisation and management

Organization and management is intended to show which entity or entities will be responsible for the various aspects of project execution and operation and how these entities will carry out their responsibilities. The discussion should demonstrate that executing agencies have adequate power, staffing, equipments and finance. It should show that adequate arrangement between and within and administrative groups responsible for various project activities. If there are deficiencies the changes and improvement required should be clearly stated.

If the administrative agency is not a government department, it may be desirable to show details about legal charts and governing board and any special provisions concerning its budget.

When there is more than one agency concerned with a project, the arrangements for coordination, joint representation on boards, joint committees and joint use of field facilities described.

It should discuss the number and caliber of the projec. staff whether time is enough for the operation of the project. Qualification and experience of the management staff may be noted. The needs of the project for professional and technical staff mentioned. Any necessary provision for assistance from expatriates should be noted and details about qualification of expatriates given. Some of the special requirements are

1. Credit administration
2. Market structure
3. Supply of inputs
4. Land reform
5. Research
6. Extension
7. Cooperatives
8. Farmer organization and participation.

Production, markets and financial results

The report should show that the results of project actions would be sufficiently attractive financially to encourage enough fish farmers to participate.

Production

The primary benefit of an aquacultural project is usually incremental output from project forms. This is the basis for the formulation of project. Projects may introduce new technologies but it should show the incremental yield to previous technologies. In any case the assumptions about yield or live stock production both with and without projects should be fully supported.

Availability of markets

It must be seen that satisfactory markets exists for the product of the project. It should be sufficient size to absorb the production proposed for the project, export the commodity involved, attention should be paid to such special situations as preferential treatment, long-term contracts or quality preferences.

Farm income

Farm budgets are fundamental to any aquaculture or rural development project analysis

and will also have been referred to in connection with or farm investment. It is important to present a fully developed analysis in the project report. It include farm budgets that indicate the inflow and outflow for each major farm model anticipated in the project, out line financing needs and project the incremental net benefits the farm family may expect.

Processing industries and marketing agencies

Detailed projections of balance sheet, income statement, sources and uses of funds statement and the incremental cash flow should be included.

Government agencies or project authorities.

In some project reports, especially if the project is to be administered by a largely self-supporting project authority, an analysis of finance from the standpoint of administering agency may be done.

Benefits and justification

This is a crucial part of the project report in which all data discussed in previous part are brought together and an assessment made; that all things considered about whether to proceed with the project.

5. Social benefits

This shows the affect of income on the poorest farmers. Like

(a) Income distribution
(b) Employment
(c) Access to learn
(d) Internal migration
(e) Nutrition and health
(f) Other indicators of the quality of life.

Some projects may have a significant effect on the quality of rural life through improvements in access to domestic water supplies, electricity, schools etc.

6. Economic benefits

Economic desirability of a project should be assessed. Economic cost and benefits are valued.

Out standing issues

All most every project will have outstanding issues that must be resolved after the preparation report is presented. These considerations may relate to project rationale policy issues affecting the project, management, staffing issues and other financing arrangements.

Part - III

Project Appraisal Techniques I

CHAPTER 7

FARM PLANNING AND BUDGETING

Introduction

All business undertakings, ranging from a few rupee corner shop to large commercial firms, plan their production and marketing operations consciously with a discriminating intellect in respect of what, how much to produce, and when and where to buy and sell. The planning of the operations and their execution is the secret of their economic success.

With the recent technological developments, fish farming has become more complex business and requires careful planning for successful operations. Most fish farmers probably have some kinds of plans about the organization and operation of their farms. Here we are interested in scientific planning planning that is systematic, written and based on the best information and aimed at achieving the maximum of satisfaction for the farmer and his family out of their resources.

Farm planning process, thus introduces a measure of economic content into farming business. Those who cannot make rational decisions and needed adjustments will find farming not a profitable proposition for them.

Definition

Farm planning is a process of making decisions regarding the organization and operation of a farm business so that it results in a continuous maximization of net returns of a farm business.

Advantages of farm planning

The various advantages of farm planning can be grouped under the following heads Income improvements

- Farm planning approach is an integrated, co-coordinated and advance programme of actions which seeks to present an opportunity to fish farmers to improve his level of income.
- It is this opportunity of income maximization, which induces farmers to adopt desirable changes.

Such income maximizations could be achieved from a given bundle of resources by re-organizing present type of production as well as introducing changes in technology.

- Farm planning is an educational tool to bring about a change in the outlook of the fish farmers and the extension workers. Knowledge of the latest technological advances in fish farming is a pre-requisite for better farm planning; so fish farmers keep their information up-to-date through this forced action situation of farm planning process.

Farm planning is an approach, which introduces desirable changes in farm organization and operations and makes the farm a viable unit.

How farm planning helps

1. It helps the farmer to think about him and gather ideas on the alternative methods and practices, which might be useful to him in his farming business.

2. It helps him to examine carefully his existing resource situation and past experiences as

a basis for deciding which of the new alternative enterprises and method fits his situation the best.

3. Within the framework of new ideas and opportunities and his own resource position, it helps him make rational decisions on what to do.

4. It helps him identify clearly the various supply needs for his alternative improved plan, i.e. estimation of the requirements of seeds, fertilizer, manures etc.

5. It helps him to find out the credit needs, if any of the new plan.

6. It gives him an idea of the expected income after paying off his loans, etc. The increased income from the new plan might act as an incentive for better future planning.

Objectives of farm planning

The ultimate objective of farm planning is the improvement in the standard of living of the farmer and immediate goal is to maximize the net incomes of the farmer through improved resource use planning.

It is generally assumed in farm planning that a farmer is primarily interested in maximizing his net income. This is probably valid for most farmers, as a higher net income provides him the means for satisfying many of his wants. It is a convenient convention, therefore, to evaluate a plan on the basis of the net income that can be derived from it.

When the objective is maximization of net income it involves commonly called" the planning horizon." The length of the planning period on the basis of the farmer's situation has to be, therefore decided. The main objective is to maximize the annual net income sustained over a long period of time.

Principal characteristics of a good farm plan

Under the Indian conditions, a good typical farm plan should have the following characteristics

1. It should provide for efficient use of farm resources such as lab our, power and equipment.
   (i) Avoid excessive risks.
   (ii) Provide flexibility in the outcome.
   (iii)Utilize the fish farmers' knowledge, training, and experience and take account of the farmers likes and dislikes.
2. Give considerations to efficient marketing facilities. Inorder to generate programme of obtaining, using, and repaying the credit.
3. Provide for the use of up-to-date modern fish farming methods and practices.

Farm budgeting

Definition

The expression of a farm plan in monetary terms of estimation of receipts, expenses and net income, is called budgeting. In other words, farm budgeting is a process of estimating costs, returns and net profit of a farm or a particular enterprise.

- Farm budgeting is a method of analyzing plans for the use of fishery resources at the command of decision maker.
- Planning without calculating the receipts and expenses in monetary terms is not of much use.

So, farm planning and budgeting go side by side.

Three major points of application of a farm budget are as under

1. Application prior to the crop farm season

The major use of a farm plan prior to the beginning of a season is to outline the Programme of work, study this Programme indicating planned organization and operational practices from the standpoint of management principles. In brief, it supplies a method by which a farmer can make his major mistakes on paper before the season starts and then find and correct these mistakes before they affect his returns or repaying capacity.

2. Application during the farm year

A farm plan is best used during the operations as a flexible guide or yardstick and not as a fixed rule for every operation. To the efficient farm manager a farm plan serves as a compass to keep the operator on the right tract.

3. Application at the end of the season

The analysis of the estimated results as compared with actual results from each of the individual enterprises and the entire farm business as a unit serve to make future plans effective in determining the strong and weak points, of the farm business and in planning for improving the efficiency and increasing net earnings.

Types of farm budgeting

Partial budgeting- enterprise budgeting and

Complete budgeting/ full budgeting

Partial budgeting

It refers to estimating the outcome or returns for a part of the business i.e. one or a few activities.

- Partial budgeting may be used as an aid in full budgeting.
- Partial budgets are commonly used to estimate the effects or outcomes of possible adjustments in the farm business before such adjustments are actually made.
- Partial budgeting analysis is simple, quick and easy.

It provides a method for deciding how far expenses and yields should be increased of a particular enterprise. It however, fails to consider all the relevant factors in maximizing net returns to the farm as a whole.

Table 4: Partial Budgeting format

Sr. Nos.	Debit (Cost)	Credit (Benefit)
1	Added Cost (A1)	Reduced Cost (B1)
2	Reduced Return (A2)	Added Return (B2)
Total	A=A1+A2	B=B1+B2

Partial budgeting (B1+B2)-(A1+A2)=B-A

Decision makers

B-A + vet Profit – change is advisable

B-A - vet Loss - change is not advisable.

Added costs includes additional expenses associated with the proposed change.

Reduced return includes listing of all receipts that would no longer be obtainable under the alternative plan.

Added return includes estimate of additional receipts that will occur from the proposed change.

Reduced cost includes listing of all input and their values, which will no longer be incurred if the change is made.

Total or complete budgeting

It refers to making out a plan for the farm as a whole or for all decisions on one enterprise. In case the budgeting analysis involves complete re- organization of the farm business, it is called complete budgeting.

Complete budgeting, considers all the crops, fish farming methods, and estimates costs and returns for the farm as a whole.

Advantages

- Brings about progressive changes in income i.e. it draws attention to a variety of factors affecting farm income.
- It takes an entire view of the farm as a whole and the resources and enterprises are considered simultaneously.

  It considers complementary, supplementary and competitive relationships between enterprises.
- It allows the substitution between resources and avoids omission of any vital part of the organization being left out of consideration.

Disadvantages

- It requires more time and efforts
- More basic data is required in accurate form

Steps in farm planning and budgeting

1. Specification of the technical co- efficient of production

Farm planner should compile all relevant information from various sources to learn some of the improved farming methods and practices and the various input-output factors that can be applied to local conditions. This kind of information must be obtained from specialists in various fields of fish farming.

The main sources of relevant information are

(1) Research trials

(2) Trials and demonstrations on farmer's fields.

(3) Farmers own trials and practical experience

(4) Information recorded by extension workers

It is important to recognize that a particular fish can be produced by any of the many different processes, e.g. carp farming can be done without water exchange, with or without fertilization and have course with various level of fertilization. In general, one will prefer the most efficient technology.

2. Specification of appropriate prices

In planning ahead, one can never be sure of prices that will obtain for different products. One simple production model that can be used is to assume prices next year will be the same as they are this year. As an alternative, we might take the average of the last three years.

3. Preparation of enterprise profitability chart

Having decided the enterprises, what prices and input-output coefficient to use as a basis of planning, one will have to evaluate the alternative opportunities and to select those opportunities, which make the best, use of the farmers resources.

4. Preparation of the farm map

Prepare farm map depicting all the physical features such as soil types, topographical features, water channels, source of water, buildings, etc.

5. Inventory of limited resources

Prepare a complete list of the farm resources, which limit the size of the different farm enterprises; such as land, lab our, buildings, machinery and liquid capital etc. This helps assessment of resource limitations and production capabilities of the farm. To these resources, possibilities of hiring or borrowing are added.

6. Examine the existing farm plan

- Work out the variable costs such as hired labour, seed, feed charges, fertilizers, insecticides etc for each enterprise.
- Work out the gross income from various enterprises.
- Work out the returns to fixed farm resources in respect of each enterprise through deducting variable costs from the gross income.

7. Locate the weakness of the present plan

A careful analysis of the resource- use in the existing plan will throw up the imbalances. The various weaknesses in the existing plan will act as guidelines for bringing about bringing about improvements in the alternative plan.

8. List out the risks to fish/ prawn production on the farm

Make a list of all such risks involved in fish/ prawn production on that particular farm and bear them in mind in developing the alternative plan. For e.g. if shrimp farming is to be undertaken risks of disease outbreaks.

9. Prepare the alternative plans

There may be a number alternative plans suiting the situation of the farmer. Within the framework of resource restrictions and keeping in view the weakness of the existing plan and the possibilities of incorporating modern technology, a few alternative farm plans may be developed.

10. Analysis of the alternative plans to check the profitability and practicability of a particular plan.

New plans are analysed for costs and returns and the optimum plan, which promises the highest returns and is most practicable on that farm situation is selected. Ideally we should evaluate alternative plans on various points such as probable income, amount of risk involved, labour and capital requirements, etc.

11. Implementing the plan

The farm planning does not end with the preparation and selection of the final plan for adoption. The most important phase is its proper execution. There may be certain difficulties in implementing the plan, unless all the problems are properly anticipated.

Illustration of partial budgeting

A fish farmer cultivating carp by traditional method wants to replace it with the composite fish culture. Analyzing the data given below, suggest whether he would adopt the technology or not.

Water spread area- 1 hectare.

Duration of culture (both traditional and CFC)= 4 months

Interest on working capital= 14 percent

Price of fish = Rs. 35 per kg

Production in traditional farming practice = 1000 kg

Working capital in traditional practice = Rs. 9000

Production in composite fish culture = 2000 kg

Working capital in composite fish culture = Rs. 20000

Table 5: Partial Budgeting Table.

Debit(Cost)	Credit (benefit)
Added Cost (A1) $11000 + \frac{(20000-9000) \times 14 \times 4}{100 \times 12}$ A1=Rs. 11513.3	**Reduced cost (B1)** Nil
Reduced Return (A2) Nil	**Added Return (B2)** (2000-1000) X 35 =Rs. 35000

Partial budgeting = B – A = Rs 23487

Since the switch over from traditional method of carp culture to CFC is profitable, he should adopt composite fish culture.

Record keeping in aquaculture farms

Diversified farm conditions and specificity of information to be gathered in a farm shows that records to be maintained varies from farm to farm. It is imperative to know the basic principles underlying preparation of forms and profoma of farm records and qualities of a good farm record system. These rules should be flexible, simple and suitable for varied farming conditions.

Characteristics of a good farm record book

(i) Simple and easy to understand.

(ii) Suitable forms for recording the type of information the farme wants to record.

(iii) Provision for an itemization and classification of all entries.

(iv) Adequate space for itemizing all entries, and the lines and spaces sufficiently wide for writing without crowding.

(v) Ample space in each section for all the entries that are likely to be recorded and

(vi) Adequate instructions for recording and analysis of the recorded data.

Parts of a farm record system –

There are three parts

i. Physical farm records;
ii. Financial farm records and
iii. Supplementary farm records

(i) Physical Farm Records

Physical aspects of the operation of a firm business are recorded in this. They not only indicate the financial position or outcome of the farm business but also record the physical efficiency or performance of the farm.

Physical farm records includes the following records

1. Farm map, soil map and contour map.
2. Charts on physical efficiency.
3. Land and water utilization record.
4. Fish or finfish production and disposal record, and
5. By-products (livestock, Agricultural commodities and other resource utilized and harvested) production and disposal record.
6. Labour records, daily work diary.
7. Machinery use records.
8. Feed records.
9. Stock / store register.
10. Poultry records.

a) Farm Map It is a simple and brief record of farm features. It provides a visual impression or a glance view of the whole location of the farm business. Relief features of the farm will be carved into it. But personal and actual observation of the physical situation and location of farm cannot be substituted by a farm map. Farm map supplements to the physical spot observation.

b) Physical Efficiency Charts it reveals the infrastructural capacity of the aquaculture farm. The maximum stocking density, seasonal output, blower capacity, generator capacity, pump HP, water-holding capacities of various tanks and the like.

c) Land and Water Utilization Records
e.g. Name of the farm AQUA-GRS

Table : 6 Resource use of the farm (Area in acres)

Land use	**1997-98**	**1998-99**	**1999-00**	**2000-01**
Bundhs and dykes	0.2	0.2	-	-
Buildings and roads	0.1	0.1	-	-
Garden	-	-	-	-
Cropped area	-	-	-	-
Idle land	-	-	-	-
Total	**0.3**	**0.3**	**-**	**-**
Water use	**1997-98**	**1998-99**	**1999-00**	**2000-01**
Rearing ponds	6.0	6.0	-	-
Brood stock ponds	3.0	3.0	-	-
Cisterns	0.5	0.5	-	-
Water feed and drain	0.4	0.4	-	-
Total	**9.9**	**9.9**	**-**	**-**

d) Production Records The importance of production records cannot be over emphasized. It provides standards of performance in the use of resources. They help to have plans based on facts of actual performance instead of guesses. The form and type of physical records relating to fish, finfish or by-product enterprises will depend upon the degree of specialization and the type of culture being followed

e.g. Shrimp Production Record
Species *P. monodon* (Tiger Shrimp-monoculture)

Table 7 : Operation wise details of the farm

Total area 4.00 ha

Sr. No.	ITEMS	Farm / Pond Nos. 1-6, Area 4.00 ha, previous culture *P. monodon*			
		Qty. No.	Date	Implement used	Remarks
1.	Pond preparation (draining and .... of funds) draining Bundh prep aration Pumping	1 1 1 1	18.4.97 18.4.97 20.5.97 25.5.97	Outlet sluice Portable pump 4HP Manual labour Pump 5 HP	Time taken 2 hrs. Time taken 2 hrs. Time taken 75 hrs. Time taken 15 hrs.
2.	Manuring Cow dung Fertilizer kg.	1 560	30.5.97 31.5.97	Manual labour Manual labour	Time taken 25 hrs. Time taken 10 hrs
3.	Stocking	1	1.6.97	Manual labour	Time taken 4 hrs.
4.	Feeding (kgs)	150	5.6.97	Manual labour	Time taken 4 hrs x 30 days
5.	Feeding (kgs)	200	5.7.97	Manual labour	Time taken 4 hrs x 30 days
6.	Fertilizing	500	6.7.97	Manual labour	Time taken 10 hrs
7.	Feeding (kgs)	950	5.8.97	Manual labour	Time taken 4 hrs x 25 days
8.	Harvesting	1	30.8.97	Cast net/pumps	50 man hrs.

Total production tons
Per hectare yield 1 ton
Income from shrimp / ha Rs. 4,03,000
e.g. Summary of Production and Disposal of the Farm product
This reveals the production and disposal record the farm produce.

e) Labour Records Labour records are of two categories

8. Simple Labour Records

Records labour used on one or more enterprises where there is some special reason to

study efficiency or seasonal requirements. Also, labour figures may be used to determine whether a particular enterprise with high labour requirements such as freshwater prawn hatchery is profitable. At the end of each day enter the number of hours of labour and blower work for each cycle. Make a summary for the year by totaling the columns. These figures may be compared with the rates of performance of compressors, pumps and other similar machines in the farm or hatchery. Seasonal distribution of labour can be made as a sub-total by months or weeks, within columns. E.g. Labour Record

Table 8: Labours records of the farm

(Modified Extensive Farming)

Species Tiger shrimp Pond No.5 Area 1 Acre Year 1998-99

Date	Pre-stock Manage-ment		Culture Package of Practices						Harvesting and Marketing					
	Man hrs	Pump (hrs)	Feeding		Fertilizing		Water		Cast netting		Draining		Sorting and Packing	
			Man	Fee-der	Man (hrs)	Spray (hrs)	Man (hrs)	Pump (hrs)	Man (hrs)	Net (hrs)	Man (hrs)	Pump (hrs)	Man (hrs)	Pump (hrs)
18.4.98	8	12	-	-	1	1	-	-	-	-	-	-	-	-
24.4.98	2	2	-	-	-	-	-	-	-	-	-	-	-	-
18.5.98	-	-	-	-	1	1	1	8	-	-	-	-	-	-
3.6.98 Every Day	-	-	1	3	-	1	3	5	-	-	-	-	-	-
3.7.98	-	-	2	5	-	-	5	10	-	-	-	-	-	-
4.7.98 Every Day	-	-	-	-	-	-	-	-	-	-	-	-	-	-
4.8.98	-	-	-	-	-	-	-	-	10	10	1	5	3	1
Total	**10**	**14**	**3**	**8**	**2**	**3**	**9**	**23**	**10**	**10**	**1**	**5**	**3**	**1**

f) Machinery Use Record (log book) The use of machines on bigger culture farms and hatcheries constitutes a heavy cost which needs to be economized. To have a full control over machine use and to study the performance of different machines, there is need to maintain proper machinery use record.

Heavy Machinery Use Record (log book)

Name of Farm Machinery Blower Size 5HP Make Leyland

Date of Purchase December 1994

Table : 9 Heavy Machinery use Record

Date	Nature of work done	Period Used			Fuel Oil Consumed (l)					Electricity consumed if applicable	REPAIRS	REMARKS
		From	To	Hour	Pre-vious balance	Purcha sed	Tot.	Consu -med	Saca nce			
5.5.95	Aera-tion	8.00 (am)	4.00 (pm)	8	5	-	5	24	21	-	-	-
8.6.95	"	11.00 (am)	4.00 (pm)	5	1	5	6	5	1	-	-	-

g) Store / Stock Register For watching the store/stock position at particular time, of different articles used at the farm, there is need to maintain store/stock register for each individual farm input.

Table 10: Store/Stock Register

Name of the Article Cow dung

Sr. No.	Date	Opening Balance	Receipt	Total	Issued	Bal.	From whom received To whom issued	Cost Rs	Bill No. & date	REMARKS
1.	1.7.99	400	-	400	-	400	Balance at hand	-	-	-
2.	6.7.99	400	2000	2400	-	2400	Purchased from village	1720.	016/ 6.7.99	-

h) Feed Records Feed costs form 60% of the aquaculture activity. The feed records may be maintained for each separate culture pond, being fed on a separate ration. The purpose of these records is to determine the feed efficiency. Feed records can show what quantities of feed are used for an entire enterprise, for a fish / fin fish per kg body weight. Thus we can calculate the out put obtained per unit of feed F.C.R. (Food Conversion Ratio) also. With a little further analysis, developing new feeding methods can enhance profits.

i) Financial Records Financial aspects of the operation of a farm business are recorded in this. These records are on

1. Farm inventory
2. Farm cash accounts or farm financial accounts.
3. Classified farm cash account and annual farm business analyses.
4. Supplementary financial records like capital assets sale register, cash sale register, credit sale / purchase register, wage register, funds borrowed repayments register, farm expenses register and non-farm income record.

CHAPTER 8

FARM FINANCIAL STATEMENTS

Introduction

In all cases of our daily/routine activities and other related activities like recreation, we tend to communicate with others to express or share our emotions, feelings. These become the key items of communication. Likewise, when we consider a business activity, its progress, financial stability and it's over all stability in the economy become the needs of communication. These in economical terms known as balance sheet, income statement & cash flow statement. This financial reporting is an essential component in the process of communication between a business and its stakeholder.

Accounting equations are developed as a representation of the relationship among key items of accounting information farm assets, farm liabilities and the ownership interest. An understanding of the accounting equation and the various elements of the equation provide a systematic approach to asuarina transactions and events. But it gives no guidance as to how the results should be communicated in a manner, which will be helpful and meaningful to users. These accounting equations are used as a basis for explaining the structure of financial statements. Ideas beyond the accounting equation are required as to what qualities are expected of financial statements.

The Accounting Period

In case of fisheries field, most business activity ranges from one-month –hatchery practice to one-year –grow out operation it needs to prepare financial statements within this period. In case of processing plants and other reduction involved industries period may vary according to need.

The convention is that business should prepare financial statements at least once in every calendar year. That convention is a requirement of law expressed in the Companies Act 1985, in the case of limited liability companies.

Financial Statements for External Users

The various financial statements produced by enterprise for the owners and other external users are derived from the accounting equation. The purposes of financial reporting, is producing information about the financial position, performance and financial adaptability of the enterprise. The three most familiar primary financial statements and their respective purposes are

Primary financial statement	Purpose is to report
Balance sheet	Financial position
Profit loss account	Performance
Cash flow statement	Financial adaptability

1. Importance of Financial Statements

Financial statement reports both on a firm's position at a point in time and on its operations over some past period. However, their real usefulness lies in the fact that they can be used to help predict the firm's future earnings and dividends, as well as the risking of these cash flows. From equity investor's viewpoint 'predicting the future' is what financial statement analysis is all about. Of course debt holders and those considering lending to the firm are also concerned with the firm's future, although the firm's 'debt investors' and its equity investors are usually concerned with different aspects of the firm's future. From management's view point, financial statement analysis is useful both as a way to anticipate future condition and more importantly as a starting point for planning

actions that will influence the future course of events for the firm.

1. Balance Sheet

It shows the financial position and stability of the business at a particular time. In balance sheet total assets and total liabilities are grouped individually, which indicates net worth or net deficit. The difference between assets and liabilities shows the distance from insolvency position greater the difference on positive side, the sounder the business. The farmer generally concerned with the immediate solvency than the ultimate solvency, it is therefore necessary to classify the assets and liabilities to know the real position of the farm business at a point of time and compare the nature of the liabilities to the assets.

Assets

Assets are sub divided into following groups,

a. **Current assets** they are the most liquid assets ands are consumable in a year. Assets such as seeds, feeds, fertilizer, cash on hand, bill receivable, and are included.

b. **Intermediate assets** these are less liquid than current assets such as farm machinery, brood stock, etc. It is consumable within one to ten years.

c. **Fixed or long-term assets** they are of the nature that it is different to convert them into cash to meet any current obligations. These are consumable in more than ten years. This includes land, building etc.

Liabilities

Liabilities are further classified into following categories

a. **Current liabilities** Repayment of these liabilities may be demanded in 12 months.

b. **Intermediate liabilities** These liabilities can be postponed or differed for the present but fall due within one to ten years.

c. **Long-term liabilities** These, which don't require repayment during the period less than ten years.

The balance sheet reflects the accounting equation in the form

Assets **minus** Liabilities **equal** Ownership interest.

And the structure of a balance sheet will be

Fixed assets
Plus
Intermediate assets
Plus
Current assets
Minus
Current liabilities
Minus
Intermediate liabilities
Minus
Long-term liabilities
Equals
Capital at start of year
Plus/minus
Capital contributed or withdrawn
Plus
Profit of the period

This format is used in the Companies Act 1985, as one of the permitted formats and it is the one most commonly used by companies.

Example of balance sheet presentation

A farmer, Mr.Narayan, who owns 2-hectares of ponds, is practicing composite fish culture (only grow out ponds). Fish culture is practiced for a six-month period. Advanced fingerlings will be stocked during September and grown fish will be harvested at the end of February month or at early month of March. His assets and liabilities at middle of the practice i.e. during December are shown as follows,

Assets

Land and buildings- 75000
Machinery and equipment- 30000
Cash in hand- 15000
Cash in bank- 10000
Feed (@ 5 tons /ha)- 15000
Fertilizers- 5000
Fingerlings- 20000

Liabilities

Hand loans- 20000
Fertilizer-5000
Feeds-10000
Loans on machinery and equipment- 20000
Loans on purchase of advanced fingerlings-8000

The following table shows how this would appear in a balance sheet-

Table:11 Mr.Narayan fish farm balance sheet as on december 2003

Fixed assets	
Land and farm buildings-	75000
Intermediate assets	
Machinery and equipment-	30000
Advanced fingerlings-	20000
Current assets	
Cash in bank-	10000
Cash in hand-	15000
Feed-	15000
Fertilizers-	2000
Total assets-	**167000**
Short term liabilities	
Hand loans-	20000
Fertilizers-	5000
Feeds-	10000
Intermediate liabilities	
Loans on machinery and equipment-	20000
Loans on purchase of advanced Fingerlings-	8000
Total liabilities-	**63000**

Net worth = Total assets – Total liabilities

= 167000 – 63000 = 105000

Inference

The balance sheet is more informative than list of assets and liabilities from which it was prepared because it has been arranged in helpful format. A person using this balance sheet can see at a glance that there is no problem for the business in meeting its current liabilities from its resource of current assets. The fixed assets used as a basis for generating profit from one year to the next are collected together as a group, although, the balance sheet alone cannot show how effectively those assets are being used. For that, a profit and loss account is needed.

2. Income statement or the profit and loss account

The profit and loss account or income statement is a summary of income and expenses of over a given time period and is one type of financial statement needed for the management of the farm business. It is often also called an operating statement. Its primary purpose is to compute profit for a given time period.

(Profit **equals** revenues **minus** expenses)

It considers operational efficiency in terms of receipts and expenditure.

Revenue/income may be in the form of cash or non-cash gains. Cash income includes payments received from selling commodities produced in the farm and from other farm related sources. And non-cash income may be assured in the form of goods and services like farm raised fish consumed by the farm household.

Receipts include returns obtained from the sale of crop production and supplementary produce and gains in the form of appreciation of farm assets.

Expenses may also be cash or non-cash in nature. Cash expenses include purchase of feed, fertilizers, seed, fuel, chemicals, electricity bill, etc. non-cash expenses include depreciation on machinery and equipment, building and purchased brood stock.

An income statement doesn't include the cost of new capital assets such as tractors, building, pipes, and others purchased during the year. Because these capital assets are used in future production and their addition in the current income statement may distort the profit for the year. Instead, part of the purchased cost is included as depreciation expenses each year of its useful life.

Also, applicable interest charges for this year may be reflected.Some of the definition related to profitability/loss are-

Net income

Net income is profits remaining after expenses have been deducted

Net income = total revenue – total expenses.

Net cash income

Net cash income is simply the difference between total cash income and total cash expenses or position of cash receipts minus cash expenses during the period for which income statement is prepared.

Net operating income

Net operating income is nothing but the difference between the gross income and total operating expenses. Operating expenses include crop loans.

Net farm income

Adjusting net cash farm income for total depreciation, net inventory changes, and values of fish products consumed in the home derive net farm income. This is the true measure for profit for the accounting period. Net farm income represents the return to the owner for personal labour, management, and equity capital used on the farm.

Example of income statement presentation

Mr. Narayan will get a yield of 16 tons (@ 8 t/ha). He sells the fish @RS. 20/kg at farm level. His returns and expenses are as follows

Returns

Returns from the sale of fish	-	320000
Appreciation on the value of assets	-	15000

Operating expenses or costs

Hired human labour	-	13500 [3 labour @RS.30/day for 150 days]
Machine cost	-	5000
Seed	-	20000 [@RS.1/kg]
Feed	-	40000
Fertilizers	-	10000
Prophylactics	-	5000
Miscellaneous	-	5000
Interest on working capital	-	20000
Interest on fixed capital	-	5000
Harvesting charges	-	16000 [@RS.1/kg]

Fixed expenses

Depreciation	-	15000
Land revenue	-	10000
Rental value of owned land	-	5000

Table:12 Income statement - A hypothetical example

	Particulars	Amount in Rs.
I	**Receipts**	
	Returns from the sale of fish-	320000
	Appreciation on the value of assets-	15000
	Gross income-	335000
II	**Expenses**	
A.	**Operating expenses**	
	Hired human labour-	13500
	Machine charges-	5000
	Seed -	20000
	Feed	40000
	Fertilizers-	10000
	Prophylactics-	5000
	Interest on working capital-	20000
	Interest on fixed capital-	5000
	Harvesting charges-	16000
	Miscellaneous-	5000
	Total operating expenses-	139500
B.	**Fixed expenses**	
	Depreciation-	15000
	Land revenue-	10000
	Rental value of owned land-	5000
	Total fixed cost-	30000

Net cash income

Net cash income = total revenue – total expenses

= 320000 – 139500

= 180500

Net operating income

Net operating income = gross income – total operating expenses

= 335000 – 139500

= 195500

Net farm income

Net farm income = gross income – total costs [includes depreciation]

= 335000 – 169500

= 165500

Inference

The resulting net profit shows how the revenue and expenses have contributed overall to increasing the ownership interest during the month.

3. The Cash Flow statement

These statements are prepared in the beginning of each year. Unlike other two statements it takes into account of future also. It shows the summary of cash inflows and cash outflows. A cash flow statement is a bonafide map of the farms expected cash income and cash outflow on a month-to-month or quarter-to-quarter basis.

In business there will be different factors causing the inflows and outflows of cash. The enterprise will try to make clear what the different causes are, subdivisions are commonly used for operating activities investing activities and financing activities.

Operating activities - these are the actions of buying and selling goods or manufacturing goods for sale or providing a service to consumers.

Investing activities - these are the actions of buying and selling fixed assets for long term purposes.

Financing activities - these are the actions of raising and repaying the long-term finance of the business.

Example of the cash flow statement presentation

In continuation of the earlier problem, the cash flow statement prepared for Mr.Narayan's farm on monthly basis starting from the month of September up to March month, taking RS. 4000 as average living expenses for each month.

Following table number 4 shows the projected cash inflows and cash outflows within this period,

Table 13 : Cash flow statement - A hypothetical example

Month	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.
Cash inflows	83000			45000			320000
Cash balance		9000	5000	46000	12000	8000	324000
Credit sales	------	-----	-----	-----	-----	-----	-----
Total inflows	83000	9000	5000	46000	12000	8000	324000
Cash outflows							
Operation cost	70000			30000			132000
Living expenses	4000	4000	4000	4000	4000	4000	4000
Loan repayment							88000
Total cash outflows	74000	4000	4000	34000	4000	4000	224000
Ending cash balance	9000	5000	1000	12000	8000	4000	100000

Note

a. During September he borrowed Rs.63000 loan and remaining Rs.2000 he put from his pocket.

b. Rs.4000 is taken as average living expenses for a six-month period.

c. In December he gets Rs.45000 revenue from other source.

d. At the end of February he will get Rs.320000 by selling harvested fish catch.

e. In March all other remaining expenses are cleared.

Inference Thus, cash flow statement gives the expected cash inflows and cash outflows during the operation.

Part - IV

Project Appraisal Techniques II

CHAPTER 9

UNDISCOUNTED MEASURES OF PROJECT WORTH

Introduction

There are two types of measures of project worth i.e. undiscounted and discounted. The basic underlying difference between these two lies in the consideration of time value of money in the project investment.

Undiscounted measures do not take into account the time value of money, while discounted measures do. In this chapter we will be dealing with undiscounted measures of project worth. Discounted measures will be dealt in the next chapter.

Various undiscounted measures of project worth are –

1. Ranking by inspection.

In some cases, we can tell by simply looking at the investment cost and the time when the net value of incremental production occurs that one project should be accepted over another if we must choose. In general, there are two instances

I) With the same investment, two projects produce the same net value of incremental production for a period, but one continues to earn longer than the other.

II) In other instances, for the same investment, the total net value of incremental production may be the same, but one project has more of the flow earlier in the time sequence, say in the second year itself than the other in the third year.

In many cases projects can indeed be examined or rejected on the basis of inspection. A clear-cut case may be two alternative investments, one of which will cost more than the return. Such a choice project analysis must be done before selecting any projects.

For example, four hypothetical projects are subjected to study each calling for an investment in an irrigation pump for intensive carp culture. All of them require the same financial investment.

For these irrigation investments, the pumps we use have no residual value after two to three years of operation. Table.14 gives details about the four alternative projects.

Table 14: Four hypothetical projects (thousands of currency units)

Project I

Year	Capital items	Operation and maintenance	Production	Gross	Value of incremental production (gross benefit)	Net value of incremental production
1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	20,000	15,000
3	-	2,000	3,000	5,000	20,000	15,000
4	-	-	-	-	-	-
Total	30,000	4,000	6,000	40,000	40,000	30,000

Project II

Year	Capital items	Operation and maintenance	Production	Gross	Value of incremental production (gross benefit)	Net value of incremental production
1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	20,000	15,000
3	-	2,000	3,000	5,000	20,000	15,000
4	-	2,000	3,000	5,000	9,000	4,000
Total	30,000	6,000	9,000	45,000	49,000	34,000

Project III

Year	Capital items	Operation and maintenance	Production	Gross	Value of incremental production (gross benefit)	Net value of incremental production
1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	7,000	2,000
3	-	2,000	3,000	5,000	19,000	14,000
4	-	2,000	3,000	5,000	31,000	26,000
Total	30,000	6,000	9,000	45,000	57,000	42,000

Project IV

Year	Capital items	Operation and maintenance	Production	Gross	Value of incremental production (gross benefit)	Net value of incremental production
1	30,000	-	-	30,00C	-	-
2	-	2,000	3,000	5,000	7,000	2,000
3	-	2,000	3,000	5,000	31,000	26,000
4	-	2,000	3,000	5,000	19,000	14,000
Total	30,000	6,000	9,000	45,000	57,000	42,000

In one instance in the example of Table 15, we would choose project II rather than the project I because, project II continues to earn for longer period even though the net value of incremental production remains same for a period for both. In another instance, we would choose project IV rather than project III because, more of its returns accrued earlier in the time sequence. We cannot tell by inspection, however, if project IV would be preferred to project II – more elaborate analysis is necessary.

2. Pay back period

The pay back period is the length of time from the beginning of the project until the net value of the incremental production stream reaches the total amount of the capital investment. The pay back period for the four pump irrigation projects is shown in the Table.15.

The pay back period is a basic and common means of choosing among investments in business enterprises, especially when the choice entails a high degree of risk. In fisheries projects, however it is not often used.

The two important weaknesses of the payback period are

It fails to consider earnings after the pay back period. Both project I and II has the same payback period of three years, but we know by inspection that project II will continue to return benefits in the third year, where as the project I will not. Hence payback period is an inadequate criterion for the choice between these two alternatives.

It does not take into consideration the timings of proceeds. Suppose we modify the project III and project IV so that each has a capital cost of 42,000. Now each has a payback period of four years and they have equal rank or order of preference for undertaking alternative investments. Yet we know by inspection that we would choose project IV over project III because, more of the returns on project IV are realized earlier. This is obviously desirable, since the earlier the benefits received; the earlier it can be reinvested (or consumed) hence, the more valuable it is.

Table 15 : Pay back period, Four Hypothetical Pump Irrigation Projects.

Project	Pay back period	Rank
1	3.0	1
2	3.0	1
3	3.5	4
4	3.5	3

3. Proceeds per unit out lay

Investments are some times ranked by the proceeds per unit out lay, which is the total net value of incremental production divided by the total amount of the investment as shown in the Table 16

By this criterion, we find that projects II and I are correctly ranked. But projects III and IV receive equal rank, although we know by simple inspection that we would choose project IV because its returns are accrued earlier. Here, again, the criterion for proceeds per unit of outlay fails to consider timing; money to be received in the future weighs as heavily as money in hand today.

Table 16: Proceeds Per Unit of Outlay, Four Hypothetical Pump Irrigation projects (thousands of currency units)

Project	Incremental cost Capital items	Total net value of incremental production	Proceeds per unit outlay	Rank
1	30,000	30,000	1.00	4
2	30,000	34,100	1.14	3
3	30,000	42,000	1.40	1
4	30,000	42,000	1.40	1

4. Average annual proceeds per unit out lay method

Another criterion for investment choice is the average annual proceeds per unit of out lay, which is obviously related to proceeds per unit out lay. To calculate this measure, the total of the net value of incremental production is first divided by the number of years it will be realized and then this average of the annual proceed is divided by the original out lay for the capital items. Table17. illustrates the measure. We see how this operates project I rank much better than project II, although we know by simple inspection that project II is the project we would choose. Similarly the criterion cannot select between projects III and project IV, although, again by inspection, we know we would prefer project IV because its benefits are accrued earlier. This criterion is misleading because it seems to allow for time by introducing " annual" in to the terminology.

This investment criterion has a very serious flaw. By failing to take in to consideration the length of the time of the benefit stream. It automatically introduces a serious bias towards short-lived- investment, with high cash proceeds.

Table 17: Average Annual Proceeds Per Unit Outlay, Four Hypothetical Pump Irrigation projects (thousands of currency unit)

Project	Incremental cost Capital items	Net value of incremental production	Average net value of incremental production	Annual proceeds per unit outlay	Rank
1	30,000	30,000	15,000	0.50	1
2	30,000	34,100	11,367	0.38	4
3	30,000	42,000	14,000	0.47	2
4	30,000	42,000	14,000	0.47	2

CHAPTER 10

DISCOUNTED MEASURES OF PROJECT WORTH

Introduction

Many economic decisions including fish production involve benefits and costs that are expected to occur at future time period. The construction of ponds race ways, and fish tank, for example, requires immediate cash outlay, which with the production and sale of fish, will result in future cash inflows or returns .In order to determine whether the future cash inflows justify present initial investment, we must compare money spent today with the money received in the future.

The time value of money influences many production decisions. Everyone prefers money today to money in the future. Therefore in order to invest a rupee in fish production today, one must be guaranteed a return in the future that is equal to or greater than the rupee invested today. The preference for the rupee now instead of a rupee in the future arises from three basic reasons Uncertainty, Alternative uses and Inflation.

Uncertainty- influences preferences because one is never sure what will take place tomorrow. Alternative uses- it will determine whether one invests in one project or another.

Inflation-affects the purchasing power of the rupee.

Interest

According to Seligman,"Interest is the return from the fund of capital." Carver has defined interest as,"The income that goes to the owner of capital." So, interest is the price paid for the use of credit. The interest rate is considered as an exchange price between present and future rupee. The interest rate can be of two type Simple and compound. Re.1 today exchanges for (1 + I) one period in the future or alternatively Re 1 payment made one period in the future exchanges 1/ (1 + I) now. (I= interest rate, either simple or compound). The interest rates are always positive because of the (+) ve time preference for money i.e. the sooner money is available, the greater its value.

Compounding

The process of finding the future of a present sum is called compounding.
We have Rs.1000 to invest in a bank paying interest at 6 percent compounded annually. (i=6percent).

After 1year we will have

Rs.1000 + Rs.1000xi
= 1000(1+i) =1000(1+0.06)
=Rs. 1,060.

After 2 year we will have

Rs.1000 (1+i)+1000(1+i) x i
=1000(1+i)(1+i) = $1000(1+i)^2$
=1000(1+0.06) = Rs.1,123.6

So a general formula for obtaining the future value of a present sum may be written as

$$V_N = Vo\,(1+i)^N$$

Where, V_N = Future value
Vo = present value
i = Interest rate
N = Number of conversion period

In case of value of a series of payments

If a fish farmer wants to invest money in a finfish production activity which will generate returns over a number of years (N). The fish farmer wants to know the value of payments a or returns after a number of years .We are finding the future value of series of payments which is easy to calculate using this formula

$$V_N = Po\,(1+i)^N + P_1\,(1+i)^{N-1} + P_2\,(1+i)^{N-2} + \ldots\ldots\ldots + Pn$$

$$= \sum_{N=0}^{N} P_N\,(1+i)^{N-n}$$

Where, V_N=the future value of a series of payments.
P_N=the payment of each conversion period (n)(n= 0, 1, 2, 3, ...N).

Example

Let us consider the income from an aerator in the pond which will yield income flows of Rs. 300,400, 500, 600, and Rs.700 during the 1st to 5th year of functioning. If we assume that interest rate is 9percent then what is future value of the series of payments?

$$V_N = 300(1.09)^4 + 400(1.09)^3 + 500(1.09)^2 + 600(1.09)^1 + 700(1.09)^0$$
$$= \text{Rs.}2,889.53$$

But the summed value of the income generated over the 5-year period is Rs.2500. The additional accrued amount is the result compounding, since it is believed that the income received is invested at 9 percent per year.

Discounting

The process of finding the present value of a future payment is called discounting. The future value must be discounted to reflect the earnings lost by not being able to immediately invest the future sum in the alternative investment. The general formula for discounting is as follows

$$V_o = \frac{V_N}{(1+i)^N} = V_N\,(1+i)^{-N}$$

For series of payments, $Vo = \sum_{n=o}^{N} \frac{Pn}{(1+i)^n}$

Where, V_o = the present value of the payment series.
Pn = the payment for each conversion period (n)
(n = 0, 1, 2, 3, ...N)

I = Interest rate.

Example

If return from five years is Rs. 300, 400, 500, 600, 700, for the 1st, 2nd, 3rd, 4th, & 5th year respectively at a discount rate of 9 percent, the present value of the return is

$$V_o = \frac{300}{(1.09)^1} + \frac{400}{(1.09)^2} + \frac{500}{(1.09)^3} + \frac{600}{(1.09)^4} + \frac{700}{(1.09)^5}$$

$$= 275.23 + 336.67 + 386.09 + 425.06 + 454.95 = \text{Rs.}1877.97$$

Discounted Measures of project worth

The technique of discounting permits to determine whether to accept for implementation, projects that have variously shaped time streams i.e., patterns of when costs & benefits fall during the life of the project that differ from one another – and that are of different durations. The most common means of doing this is to subtract year-by-year the costs from the benefits to arrive at the incremental net benefits stream-the so-called cash flow-and then to discount that. This approach will give one of three discounted cash flow measures of project worth- the net present worth , the internal rate of return or the net benefit investment ratio . Another discounted measure of project worth is to find out the present worth of the cost and benefit stream separately and then to divide the present worth of the benefit stream by the present worth of the cost stream to obtain the benefit-cost ratio.

Because the benefit and cost streams are discounted, the benefit –cost ratio is a discounted measure of project worth. But because the benefit and cost streams are discounted separately rather than subtracted from one another year-by-year, the benefit-cost ratio is not a discounted cash flow.
Discounted pay back period

It is a simple method which estimates the length of the time required for an investment to itself out; that is the number of years required for a firm to cover its original investment from the net cash inflows.

Although the period is easy to calculate, it can lead to erroneous decisions .As can be seen from our example, it ignores income beyond the payback period, & therefore is biased towards projects with shorter maturity periods .The pay back period is sometimes used by investors who are short of cash and need to reinvest all cash flows that occur in early stages of the projects. Investors who are risk averse often use this technique in evaluating projects. Such investors need to receive cash at the early stages of projects since the future is uncertain. This, the payback period method is somewhat better reflection of liquidity than profitability.

Table 18: Net cash inflow for project A & B

Project A					Project B				
Year	Invest-ment	Net Cash Inflow	Discount factor (12%)	Present value of Net cash inflow	Year	Invest-ment	Net Cash Inflow	Discount factor (12%)	Present value of Net cash inflow
0	2000	-	1. 000		0	2000	-	1. 000	
1		700	0. 893	635. 10	1		300	0. 893	267. 90
2		600	0. 797	478. 20	2		400	0. 797	318. 80
3		500	0. 712	356. 00	3		500	0. 712	356. 00
4		400	0. 636	254. 40	4		600	0. 636	381. 60
5		300	0. 567	170. 10	5		700	0. 567	396. 90
6		200	0. 507	101. 40	6		800	0. 507	405. 60
7		100	0. 452	45. 20	7		900	0. 452	406. 80

The first project (A) is a Rs.2000 investment for the purpose of one aerator, & the second (B) is to invest in a feed shed of equal cost. The payback period for the aerator is 3.5 years and that for feed shed is approximately 4.3 years. If decision- maker wants to cover the cost of investment in the shortest period of time, project (A) will be preferred over (B). But this decision completely unwise because the discounted payback periods for project (A) & (B) are nearly 6.8 years and 5.8 years respectively. So the project (B) is to be preferred over the other one and this will be actually wise decision.

Derivation of Incremental Net-Benefit (Incremental cash flow)

When we consider a project, we see it as earning a gross benefit streams from which we must deduct the capital investment and pay the operation costs-the costs of machinery, fertilizer, hire labour, consultants and the like. What is then left over is a residual (what will likely be negative in the early years of the project) that is available to recover the investment made in the project (the return of capital) a compensate for the use of resources invested in the project (the return to or on capital). The residual is the net benefit stream. Deducting the without-project net benefit gives the incremental net benefit stream.

The major characteristic of the incremental net benefit stream or incremental cash flow is that it includes, without differentiating, both the return of capital and return to capital. To compute the incremental net benefit or cash flow we do not deduct from the gross benefit neither any allowance for the depreciation (that is return of capital) nor any allowance for interest on the capital investment employed that has been supplied by the entity for which we are doing the analysis.

We do not deduct depreciation because the incremental net benefit stream already allows for the return of capital over the life of the project.

We do not deduct interest on the capital supplied by the entity for which we are doing because in effect the result of a discounted cash flow analysis is the allowance for the return to the entity's capital.

Income taxes must be deducted to arrive at the incremental net-benefit. It may include non-cash elements like values of home- consumed production and of wages in kind.

The incremental net benefit is the increase in net benefit with project as opposed to the case without project. In early stages of the project the incremental net benefit usually is negative. The net incremental benefit is the basis for calculating measures of project worth, the most important of which are discounted measures of Net Present Value (NPV), Internal Rate of Return (IRR) and Net Benefit Investment Ratio (N/K) ratio. In reaching these measures (usually called Discounted cash flow analysis), costs are entered in the year they are incurred, and benefits are entered in the year they are realized. As a result, no depreciation is deducted before arriving at the incremental net benefit.

In building project accounts for the financial analysis, the incremental net benefit may be derived as (1) the incremental net benefit before financing in which case any financing transaction is excluded, and (2) after financing in which case loans or their financial receipts are added to the incremental net benefit and debit service or other financial payments are subtracted from the incremental net benefits.

Net present value (NPV)

It is a discounted cash flow technique (DCF) .It is the present value discounted at firm's required rate of return on the stream of net cash flows from the project minus the project's net investment. The NPV method uses the discounting formula of a non-uniform or uniform series of payments to value the projected cash flow for each investment alternative at one point in time. To obtain the NPV, the following formula is used -

$$NPV = -INV + \frac{P_1}{(1+I)^1} + \frac{P_2}{(1+I)^2} + \frac{P_3}{(1+I)^3} + \ldots\ldots\ldots\ldots + \frac{P_n}{(1+I)^n}$$

Where, $P_i \ldots\ldots\ldots\ldots P_n$ are net cash flows.

i = the interest rate or marginal cost of capital .

n = the project expected life.

INV = the initial investment.

The model indicates that the net cash flows of the project are discounted and then added to yield the NPV. The initial investment is negative since it represents a cash flow.

Or

$$NPV = \sum_{t=1}^{n} \frac{P_t}{(1+i)^t} - INV$$

An investment project would be accepted if the NPV > 0 and rejected if NPV < 0. This is because the money being invested is greater than the present value of the net cash flow. If NPV=0, the decision maker would be indifferent. The NPV method assures that funds may be reinvested at the firm's interest rate. In case of series of cash out flows and cash inflows the can be written as

$$NPV = \sum_{t=1}^{n} \frac{B_t - C_t}{(t+i)^t}$$

Where,

B_t = Benefit in each year C_t = Cost in each year

i = Discount rate

Benefit cost ratio (BCR)

It is also called as Profitability Index (PI). It is the ratio of present value of future net cash flows over the life of the project to the net-investment.

$$PI = \frac{\sum_{t=1}^{N} \frac{P_t}{(1+I)^t}}{INV} \quad \text{or} \quad PI = \frac{\sum_{t=1}^{n} \frac{B_t}{(1+t)^t}}{\sum \frac{C_t}{(1+I)^t}}$$

(in case of series of cash inflows and outflows in a year)

The method usually produces the same result as the NPV and IRR in project evaluation, but it is very important in separating projects of varying sizes. If a project has a PI value greater than or equal to1, (PI = 1) it should be accepted and should be rejected if the PI value is less than 1 (PI<1).

Example A fish culturist has invested and got Net benefit at the end of 1st, 2nd, 3rd & 4th year of fish culture in the following way

Table 19: Investment benefit stream of a hypothetical project.

Year	Investment (Rs.)	Net benefit	Discount factor (12%)	Present value investment	Present value of Net benefit
0	40,000	-	1.000	40,000	-
1	2,000	15,000	0.893	1,786	13,395
2	3,000	20,000	0.797	2,391	15,940
3	4,000	19,000	0.712	2,848	13,528
4	1,000	16,000	0.636	636	10,176
Total	50,000	70,000		47,661	53,039

NPV = Present value of Net benefit – present value of investment
= 53,039 – 47,661 = 5378 (+) ve

$$\text{BCR or PI} = \frac{\text{Present value of Net benefit}}{\text{Present value of investment}} = \frac{53,039}{47,661} = 1.11 \text{ (more than 1)}$$

Internal Rate of Return (IRR)

It is the interest rate that will equate the sum of net cash flows to the initial investment. The interest rate that satisfies this equation is called internal Rate of Return (IRR).

There is no way of finding the IRR. One is forced to use a systematic procedure of trial & error to find out the discount rate that will equate the net cash flows to the initial investment.

When the NPV =0, then

$$\sum_{t=1}^{n} \frac{P_t}{(1+i)^t} = INV \quad \text{or} \quad \sum_{t=1}^{n} B_t - C_t = 0 \text{ (in case of series cash flows)}$$

$(1+I)^t$ I = Internal Rate of Return (IRR)

Acceptability of project depends upon comparing the IRR with the investor's required rate of return (RRR) sometimes called minimum acceptable rate of return (MARR). If IRR is greater

than RRR (MARR), accept the project, if IRR is less than that, reject the project, if IRR=RRR, be indifferent.

If NPV is greater than (or less than) zero (0), and only if the IRR is greater than (or less than) RRR, the NPV & the IRR method result in identical decisions to either accept or reject an independent project.

The IRR method implicitly assumes that returns from an investment are reinvested to earn the same rate as the IRR of interest

Table 20: Investment benefit stream of a hypothetical project.

Example Initial investment capital for composite fish farming is Rs.25, 000.

Year	Cash flow (Rs.)	Discount factor (12% Ra)	Present value (12%)	Discount factor (20% Rb)	Present value (20%)
1	12,000	0.8929	10,715	0.8333	10,000
2	10,000	0.7972	7,972	0.6944	6,944
3	8,000	0.7118	5,094	0.5787	4,630
4	6,400	0.6356	3,432	0.4823	2,604
Total			27,813		24,178

NPV (for 12percent discount rate Ra)= 27,813-25,000 = 2813

NPV (for 20percent discount rate Rb)= 24,178-25,000 = - 822

$$IRR = R_a + \frac{(Pv-C) \times r}{\Delta Pv}$$

where R_a = Minimum rate of interest (i.e. 12 percent as bank rate of interest)

Pv = Present value of cash flow (at R_a)

C = Capital

ΔPv = Difference between the present values

= NPv (R_a) - NPv (R_b)

$r = R_b - R_a$

$$= 12 + \frac{(27,813 - 25000)}{3635} \times 8$$

= 18.19 percent

Net-Benefit Investment Ratio (N/K ratio)

This is also a discounted measure of project worth.

$$N/K \text{ ratio} = \frac{\text{The present worth of the net benefits}}{\text{The present worth of the investments}}$$

$$N/K \text{ ratio} = \frac{\sum_{t=1}^{n} \frac{N_t}{(1+I)^t}}{\sum_{t=1}^{n} \frac{K_t}{(1+I)^t}}$$

Where, Nt = incremental net benefit in each year after stream has turned positive

K_t = incremental net benefit in initial years when stream is negative.

T = 1 ,2 ,3 ,.....n

n = No. of years

I = interest (discount) rate

The selection criterion is to accept all projects with a net benefit-investment ratio (N/K) of 1 or greater.

Selection Among The Project Alternatives

Let us consider the following four cases of fisheries projects- we have to choose the best one of the 4 projects.

Table 21: Investment benefit stream of for hypothetical project.

Project (1)

I——————————— Incremental cost ———————————I

Year	Capital item	Operation & Maintenance Cost	Production Cost	Gross Cost	Value of incremental production (Gross benefit)	Net value of incremental production Œ
1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	20,000	15,000
3	-	2,000	3,000	5,000	20,000	15,000
4	-	-	-	-	-	-
Total	30,000	4,000	6,000	40,000	40,000	30,000

Project (2)

1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	20,000	15,000
3	-	2,000	3,000	5,000	20,000	15,000
4	-	2,000	3,000	5,000	9,100	4,100
Total	30,000	6,000	9,000	45,000	49,100	34,000

Project (3)

1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	7,000	2,000
3	-	2,000	3,000	5,000	19,000	14,000
4	-	2,000	3,000	5,000	31,000	26,000
Total	30,000	6,000	9,000	45,000	57,000	42,000

Project (4)

1	30,000	-	-	30,000	-	-
2	-	2,000	3,000	5,000	7,000	2,000
3	-	2,000	3,000	5,000	31,000	26,000
4	-	2,000	3,000	5,000	19,000	14,000
Total	30,000	6,000	6,000	45,000	57,000	42,000

□ The net value of incremental production is the value of incremental production less the operation & maintenance cost of the project.

Table 22: NPV, IRR, BCR &N/K ratio of the four projects

Project (1)

Year	Gross cost production (Gross Benefit)	Value of Incremental cash flow	Incremental net benefit (12%)	Discount factor (12%)	Present worth Rate of Return Discount Factor	Present worth calculation Internal (IRR) Present worth (0%)	(0%)
1	30,000	-	-30,000	0.893	-26,790	1.00	-30,000
2	5,000	20,000	+15,000	0.797	+11,955	1.00	+15,000
3	5,000	20,000	+15,000	0.712	+10,680	1.00	+15,000
4	-	-	-	-	-	-	-
Total	40,000	40,000	0	2.402	-4,155	3.00	0

Net present worth (value) NPV at 12percent = - 4,155,

Benefit cost ratio (at 12percent) =0.83

Internal Rate of Return = 0 percent

N/K ratio (at 12percent) =22,635÷26,790= 0.84

Project(2)

D.F(at 8%) P.W (at 8%)

1	30,000	-	-30,000	0.893	-26,790	0.926	-27,780
2	5,000	20,000	+15,000	0.797	+11,955	0.857	+12,855
3	5,000	20,000	+15,000	0.712	+10,680	0.794	+11,910
4	5,000	9,000	+4,100	0.636	+2,608	0.735	+3,014
Total	45,000	49,000	+4,000	3.038	-1,547	3.312	-1

Net present worth (NPV) at 12percent = -1,547

Benefit cost ratio (12percent) = 0.96

IRR = 8percent

N/K ratio (at12percent)) = 25,243 ÷ 26,790 = 0.94

Project(3)

DF (at14%) PW (at14%)

1	30,000	-	-30,000	0.893	- 26,790	0.877	-26,310
2	5,000	7,000	+2,000	0.797	+1,594	0.769	+1,538
3	5,000	19,000	+14,000	0.712	+9,968	0.675	+9,450
4	5,000	31,000	+26,000	0.636	+16,536	0.592	+15,392
Total	45,000	57,000	+12,000	3.038	+1,308	2.913	+70

Net present worth (NPV) at 12percent = 1,308

Benefit cost ratio (12percent) = 1.03

IRR = 14percent

N/K ratio (at12percent) = 28,098 ÷ 26,790 = 1.05

Project(4)

DF (at16%) PW (at16%)

1	30,000	-	- 30,000	0.893	-26,790	0.862	-25,860
2	5,000	7,000	+2,000	0.797	+1,594	0.743	+1,486
3	5,000	31,000	+26,000	0.712	+18,512	0.641	+16,666
4	5,000	19,000	+14,000	0.636	8,904	0.552	+7,728
Total	45,000	57,000	+12,000	3.038	+2,220	2.798	+20

Net Present worth (at 12percent) = 2,220

Benefit cost ratio (at 12percent) = 1.06

IRR = 16percent

N/k ratio (at 12percent) = 29,010 ¸ 26,790 = 1.08

It is clear that we would reject both the project (1) & (2) at 12percent discount rate. We would accept the project (2) if the discount rate were 8percent or lower and it would have a net present worth of zero (0) or greater than zero (0), an internal rate of return at or above the cut off rate, and a net benefit-investment ratio of 1 or greater than one. At the 12percent discount rate we would accept both projects (3) and (4). Since both have positive net present worth (NPV), internal rate of return (IRR) above the cut off rate, and benefit cost & net benefit investment ratios greater than one (1). If, however, our investment funds were limited to some 30 thousands rupees (ignoring any problem of the cash flow within 2 years), we would have to choose between projects (3) & (4).

We can see that by increasing the discount rate, an unambiguous choice would be made. If we set the discount rate 15percent, we would accept only project (4), which would have a positive net present value (NPV) and an IRR value just above the cut off rate. We would have just used all our investment funds, so our selection criterion would be clear.

Alternatively, and more simply, we could select project (4) on the basis that it has the higher net benefit –investment ratio at a 12percent discount rate.

At any given discount rate, we cannot use the net present worth, or the IRR or the benefit cost ratio as ranking measures; our criteria tell us only to accept all projects which meet the selection criteria for these three measures. The net benefit – investment ratio is the only measure of the ones that can be used with confidence to rank directly project (4) ▸ **1st**, (3) ▸ 2nd, (2) ▸ 3rd, (1) ▸ 4th.

CHAPTER 11

RISK AND UNCERTAINTIES IN PROJECTS

Introduction

In project analysis once the stream of costs and benefits for a project is defined in the form of cash flows, the next step is to assess the worthwhileness of the project using a variety of appraisal criteria (or evaluation methods).

A project manager will search for the project that will satisfy the project goals, and that includes the wisest and best use of resources to satisfy human wants. The most common criteria employed in determining the financial desirability of investment projects are NPV, BCR and IRR.

One of the real advantages of careful economic and financial analysis in fisheries project is that it may be used to test what happens to the earning capacity of the project if events differ from guesses made about then in planning for e.g. a disease outbreak, fall in prices, natural calamities like floods, etc. These unforeseen incidents can be grouped into two i.e. risks and uncertainties

1. Risk

Few management decisions are made under conditions where the outcomes associated with each possible course of action are known with certainty. Most major managerial decisions are made under conditions of uncertainty. The frequency of uncertainty in managerial decisions and the risk involved dictate risk analysis be given due consideration in farm and project management decisions. Risk refers to the possibility that some unfavorable event will occur. The probability of a risk occurring can be quantified. It is the possibility of loss, injury, or exposure to harm. In aquaculture, risk comes from stock losses. Anything, which disrupts the rearing of fish, is likely to jeopardize production and marketing of the final product.

The levels of risk vary among species and at different stages of production. The relative lack of knowledge of fish biology in comparison to some land animals makes fish production more risky than the production of food animals. As Secret an (1988) indicates, on a scale of 1 to 100, we know 75 percent of the biology of human beings, and perhaps 50 to 60 percent of the biology of chickens, cows, pigs and other farm animals, but only about 20 percent of the biology of aquatic species. There are numerous risks involved in the breeding, hatching and growing of aquatic organisms under intensive management systems.

What sort of risks plagues the aquacultural industry? Risks may be classified into main groups (1) socio-economic or business risk and (2) physical or pure risks.

Types of Risk

Socio-Economic/Business

Social aspects of socio-economic risks include changes in tastes, attitudes, or social behavior towards production an consumption of a certain species. The expansion of aquaculture depends on individuals changing their attitudes towards species cultured under intensive closed systems. This may be done through government programs, advertising, and public relations. For example, changes in consumer purchases of catfish have been achieved through advertising and public relations. The growing popularity of catfish may be stifled, however, if "off flavour" problems continue to plague the industry.

Economic risks

Economic risks such as changes in price of inputs and output inflation, recession, depression and other economic conditions that affect national income are primary concerns of commercial fish producers. As demand lags behind supply, producers are concerned that prices will fall. This is presently the case in the U.S. catfish industry. Producers are being warned that they should secure markets before expanding production. Also, the degree of elasticity with respect to supply an demand at both the farm and processor level is a clue to the level of economic risks associated with fish production. Processors facing a more inelastic demand than producers will tend to be less concerned about demand lags. This is one reason that producers are beginning to favor more producer associations or cooperative type marketing organizations.

Marketing risks

Risks may also result from uncertainty in demand, supply and prices. When to move the product to market is the age-old nemesis of farmers. Fish farmers are no different. Significant seasonal price level differences exist in many aquaculture product markets. Today, more farmers in colder climate are over wintering fish to try to market them when thee is less supply available to consumers. Additionally, new technologies and product forms are being evaluated in an attempt to avoid some of the marketing risks. Smoked fish as well as dried, frozen, or canned fish are forms used in various markets to reduce the risks associated with marketing time.

Assume that forecasters are overly optimistic in their estimates of prices and consumer demand. This optimism is likely to encourage farmers to intensify production (higher stocking rates) in the short-run and expand production (more ponds) in the long run. Intensification increases the potential for diseases, problems such as "off-flavor", and other environmental concerns. The fish arrive at the market only to remain unsold because of weak consumer demand resulting from a dislike for the quality of the fish on the shelf, or insufficient income to purchase fish and other market foods.

Longer-term expansion of production means greater amounts of capital and land committed to the aquacultural practice. Because ponds are much easier to build than to remove, these commitments tend to become irreversible, even if prices decline. Once again market conditions dictate difficulties for the producer.

Production risks

Many of the marketing risks are also related to production problems. Marketing problems may be logistical in nature, which may impede production schedules. The timely supply of fingerlings may affect the quantity of food fish produced at a given time. This may result in grave financial problems for producers. Production risks may also be due to lack of trained manpower to manage the operation. This results in serious constraint or even failure in any aquacultural enterprise.

Other risks

Other socio-economic risks encountered are financial and political. Financial risks relate to changes in supply of funds for production and marketing. Credit restriction and availability often affect the aquacultural industry. Lack of education and understanding of aquacultural production processes among lenders is common in areas where the industry is developing.

Political risks affect not only an enterprise, but the whole sector. Changes in government and governmental policies have been known to cause changes in supply and demand of inputs and fish. Governmental regulations may affect all stages and aspects of the industry. Regulations on

feed, import of inputs, the introduction of species, and changes in labour laws may greatly influence the industry.

Physical or pure risks

Physical risks results from conditions of nature, such as rain windstorms, clouds, flooding, and drought. Other types of pure risks are plant breakdowns, and failure of safety and other devices. These risks associated with physical or pure risks can be managed to minimize their effects on producers.

2. Uncertainty

It is a situation in which the probability of an outcome is not known. Insurance cannot provide any cover against uncertainty. Uncertainty is a state of being doubtful about future events, which cannot be foreseen exactly.

Types of Uncertainty

Price uncertainty It is associated with the price of products and input factors, such as price of fish in a market.

Yield uncertainty The fluctuations in yield are associated with weather conditions and incidence of diseases and pests and the impact of new practices.

Technological uncertainty Technological changes influence production function and create conditions of variability, which, in turn, lead to uncertainty.

Institutional uncertainty Conditions of tenure, functioning of credit agencies, action and outlook of farmers are examples of institutional uncertainty.

Normally risks and uncertainties are removed by the following methods

(a) Diversification
(b) Crop insurance
(c) Continuous or Sequential Marketing
(d) Future Market or Production Contracts
(e) Government Programs
(f) Third-Party Equity Capital
(g) Use of Safety Device

The risk and uncertainties in the fisheries projects can be accounted by the following methods

Sensitivity analysis

Sensitivity analysis is a simple technique to assess the effects of adverse changes on a project. It involves changing the value of one or more selected variable and calculating the resulting change in NPV or IRR. The extent of change in the selected variable to test can be derived from post evaluation and other studies of similar projects. Changes in variables can be assessed one at a time to identify the key variables. Possible combinations can also be assessed. . Sensitivity analysis answers questions like what happens to NPV if the sales of the output are 10 tons rather than the expected 15 tons? What will happen to NPV if the economic life of the project is only 6 yrs rather than the expected 8 years? How sensitive is the projects financial and economic rate of return or net benefit investment ratio to increased construction costs etc.

Where the project is shown to be sensitive to the value of a variable that is uncertain, mitigating actions should be considered. This can include project level actions, such as long-term supply contracts or pilot phases; sector level actins, such as price changes or technical assistance programs; or national level actions, such as changes in tax and incentive policies, where there is exceptional uncertainty, the project may have to be redesigned or implemented first on pilot basis.

Sensitivity and risk analysis can be used to assess the effects of changes in project variables that are quantified. The results can be presented together with recommendations on what actions to take or which variables to monitor during implementation and operation. However, many projects involve institutional and social risks that cannot be readily quantified. A statement of such risks and any mitigating actions should be included alongside the conclusions from sensitivity and risk analysis.

Merits of sensitivity analysis

1. It forces management to identify the underlying variables and their relationships.
2. It shows how robust or vulnerable a project is to change in underlying variables.
3. It indicates the need for further work in terms of gathering information if NPV or IRR is highly sensitive to changes in some variable

Generally projects are sensitive to change in 4 principal areas. These and the technique of sensitivity analysis are considered below

Uncertainties of Price Receivables

Probably every aquacultural project should be examined to see what happens if the assumptions about the sale price of the project's product prove wrong. For this the analyst can make alternative assumptions about future prices and see how these affect the net present worth the financial and economic rates of return, or the net benefit-investment ratio (often abbreviated as N/K ratio).

Delay in implementation

Delay in implementation affects most aquacultural projects. Farmers may fail to adopt new practices as rapidly an anticipated or they may find it harder to master new techniques than was thought. Other technical difficulties may be underestimated. There may be delays in ordering and receiving new equipment. Unavoidable administrative problems and requirements may delay the project. Testing to determine the effects of delay on the net present worth, the financial and economic rates of return and the net benefit investment ratio of a proposed aquacultural investment is an important part of the sensitivity analysis.

Cost overrun

Almost every aquacultural project should be tested for sensitivity to cost overrun. Projects tend to be very sensitive to cost overrun especially for construction because so often the costs are incurred early in the project when they weigh heavily in the discounting process and are for facilities that must be complete before any benefit can be realized. A project that has a quite attractive return if the estimated cost is in fact realized may be only marginally acceptable or unacceptable if costs early in the implementation phase rise significantly.

That cost estimates often are not very firm is one more reason why projects should be tested for cost overrun.

A test that shows a project to be very sensitive to cost overrun may signal to those who must make investment decisions that it is important to have firms cost estimates before proceeding

with the final decision, even if obtaining firm estimates may mean a delay in the start of project implementation. If a project manger and those to whom he reports that it is important to contain costs if the project is to make its expected contribution to increasing national income.

Yield

The analyst may wish to test a proposed project for its sensitivity to errors in estimated yield. There is a tendency in projects to be optimistic about potential yields, especially when a new cropping pattern is being proposed and the information is based mainly on experimental trials. A test to determine how sensitive the projects net present worth, financial and economic rates of return, or net benefit-investment ratio are to lower yields not only may provide information useful in deciding whether to implement the project, but also may emphasize the need to ensure sufficient extension services if the project is to be as high-yielding as could reasonably be experienced.

Sensitivity analysis is a straightforward (but often quite sufficient) means of analyzing the effects of risk and uncertainty in project analysis. A much more elaborate technique of risk analysis using probability [Pouliquen (1970) approach] is generally called "probability analysis". In contrast, the techniques we have been discussing (including sensitivity analysis) are usually called "most probable outcome analysis".

Example:

For the following fisheries project perform the sensitivity analysis for the three different cases of

(i) Increasing cost of capital.

(ii) Increased cost of project due to risks involved at 10 and 20 percent cost like.

(iii) Uncertainties due to the differences in the price receivables at 10, 20 and 30 percent reduction for the yield.

Sensitivity analysis

Table 23 : Case I Increasing Cost of Capitals

Y*	Cost	Bene -fit	D.F. 12%	D.C. 12%	D.B. 12%	D.F. 20%	D.C. 20%	D.B. 20%	D.F. 25%	D.C. 25%	DB. 25%
1	25000	0	1	25000	0	1	25000	0	1	25000	0
2	5000	20000	0.893	4465	17860	0.833	4165	16660	0.8	4000	16000
3	5000	20000	0.797	3985	15940	0.694	3470	13880	0.64	3200	12800
4	5000	20000	0.712	3560	14240	0.579	2895	11580	0.512	2560	10240
5	5000	20000	0.636	3180	12720	0.482	2410	9640	0.41	2050	8200
6	5000	25000	0.567	2835	14175	0.402	2010	10050	0.328	1640	8200
				43025	74935		39950	61810		38450	55440
				NPV	31910		NPV	21860		NPV	16990
				BCR	1714		BCR	1.5471		BCR	1.4418

Y* - Year

Inference

The computation of the NPV and BCR at different cost of capital indicates that the project is feasible and profitable even at 25 percent discount rate. At 25 percentages discount rate also there exists a positive NPV and BCR of more than one. The exercise indicates the high yielding capacity of the project even at higher discount rates.

Table 24: Case II Escalation of the cost of the project due to the different risks involved

Y*	Cost	Bene -fit	D.F. 12%	D.C. 12%	D.B. 12%	Cost incre-ase by 10%	D.C. 12%	D.B. 12%	Cost incre-ase by 20%	D.C. 12%	DB. 12%
1	25000	0	1	25000	0	27500	27500	0	30000	30000	27500
2	5000	20000	0.893	4465	17860	5500	4911.5	17860	6000	5358	4911.5
3	5000	20000	0.797	3985	15940	5500	4383.5	15940	6000	4782	4383.5
4	5000	20000	0.712	3560	14240	5500	3916	14240	6000	4272	3916
5	5000	20000	0.636	3180	12720	5500	3498	12720	6000	3816	3498
6	5000	25000	0.567	2835	14175	5500	3118.50	14175	6000	3402	3118.5
				43025	74935		47327.5	74935	60000	51630	47327.5
				NPV	31910		NPV	27607.5		NPV	-4302.5
				BCR	1.71		BCR	1.58		BCR	0.92

Y* - Year

Inference

On increasing the cost of the project taking into consideration the different risks involved the computed NPV and the BCR values indicate that the project is feasible and economical unto a discount level rate of less than 20 percent cost increase. At 20 percent increase in the total cost of the project the NPV appears to be negative and the BCR is lesser than one, which are negative indicators of project appraisal.

Table 25 : Case III Uncertainties resulting due to the differences in the price receivables

Y*	Cost	Bene - fit	DF 12%	DC 12%	DB 12% of 10%	Redu-ction in benefit - efit	Dis-coun-ted ben of 20%	Redu-ction in benefit - efit	Dis-coun-ted ben of 30%	Redu-ction in benefit - efit	Dis-coun-ted ben
1	25000	0	1	25000	0	0	0	0	0	0	0
2	5000	20000	0.893	4465	17860	18000	16074	16000	14288	14000	12502
3	5000	20000	0.797	3985	15940	18000	14346	16000	12752	14000	11158
4	5000	20000	0.712	3560	14240	18000	12816	16000	19392	140000	9968
5	5000	20000	0.636	3180	12720	18000	11448	16000	10176	14000	8904
6	5000	25000	0.567	2835	14175	22500	12757.5	20000	11340	17500	9922.5
				43025	74935		671441.5	84000	59948	73500	52454.5
				NPV	31910	NPV	24416.5	NPV u	16923	NPV	9429.5
				BCR	1.71	BCR	1.56	BCR	1.39	BCR	1.21

Y* - Year

Inference

The uncertainties in the project benefit stream can be sensitized by the ex-ante approach of reducing the anticipated project benefit stream at 10,20, 30 percentages. The computed NPV and BCR ratios indicate that the project can withstand uncertainties to the tune of even 30 percent reduction in the yield due to the different uncertainties. The NPV and BCR at 30 percentage reduction in the yield in the project benefit stream was found to be Rs 9429 and1.21 respectively

Limitations of sensitivity analysis

(i) It may fail to provide leads if sensitivity analysis merely presents complicated set of switching values it may not shed light on the characteristics of the project.

(ii) The study of the impact of variation in one factor at a time, holds, other factors constant, may not be very meaningful when underlying factors are likely to be interrelated.

Switching value

A variation of sensitivity analysis is the "Switching value". In straightforward sensitivity analysis we choose an amount by which to change an important element in the project analysis and then determine the impact of that change on the attractiveness of the project. In contrast, when we calculate a switching value we ask how much such an element would have to change in an unfavourable direction before the project would no longer meet the minimum level of acceptability as indicated by one of the measure of project worth. Then those responsible for determining whether to proceed with the project can ask themselves how likely they feel it is that there will be a change of that magnitude.

Applying contingency allowances

There is a considerable element of construction in the earlier years, the engineers will often include a contingency allowance Physical contingency allowances and contingency allowances intended to reflect relative price change are real costs in both financial and economic analysis and should be incorporated directly into the project accounts even when the analyst is working in constant prices.

The contingency allowance intended to allow for general inflation however, does not enter into the project accounts, either financial or economic, when the analyst is working in constant prices. This means that when inflation is expected to be significant, a separate financing plan will be needed to give those responsible for making budget allocations a better idea of the amounts in current terms that they will be asked to make available.

Contingency allowances are usually not included for the operating costs of a project once the initial investment stage is passed. Rather, problems such as higher than anticipated production expenditures are customarily analyzed by using sensitivity analysis and a judgment is then made about whether to change the design of the project or to abandon it.

Physical contingency allowances usually are estimated separately for each major category of cost and separately for local and foreign exchange costs. Projects that include large civil engineering works require higher contingency allowances than projects that cover only the supply and erection of equipment.

Contingency allowances for relative price changes during the early investment phase of a project may reflect anticipated influences arising from domestic price increases, the expected trend of prices in leading supplier countries, price increases the expected trend of prices in leading supplier

countries, price trends for particular kinds of work, or kinds of equipment to be used, and the possible effect of the project in exerting a strong upward pull on prices of locally supplied labour and raw materials.

Replacement costs

Many aquacultural projects require investments that have different lifetimes. A good example is found in the case of water pumping unit in which the earthworks and pump platforms may be expected to last about ten years but the pumps themselves may have a life of only five to six years. In preparing the analysis, allowance must be made for the replacement costs.

Treatment of replacement costs is simple. The analyst includes them among the capital items for the appropriate year in the project analysis. In analysis of the net present worth, internal rate of return, and net benefit investment ratio, the replacement costs are then netted out when the cash flow is computed. This may make the cash flow for that particular year negative, but only rarely in an agricultural project could this introduce analytical complications.

Often at the end of a project there may reasonably be expected to be some residual (or terminal) value. That is, the capital asset will not have been all used up in the course of the project period, and there will be "residual asset". The way to handle this is to treat the residual value of any capital item (say a dam or a stand of trees) as a project "benefit" during the last year of the analysis period.

Part - V

Project Implementation

CHAPTER 12

OBJECTIVES AND TASKS OF PROJECTS

Objectives and Tasks in Implementation of Projects

The implementation phase consists of two sub-phases (1) pre-operation phase and (2) operation phase. The pre-operation phase may be considered to be complete when various components of the project are installed and put into operation. The pre-operation phase of the implementation begins when the feasibility report has been completed and financing has been arranged.

Objectives In Pre-operation and Operation Phases

The objectives of the project management system in the pre- operation phase are as follows
Completion of the project on time
Completion of the project within contemplated costs
Completion of the project at a profit to the company

The primary objective of the project managerial system, when the unit becomes operational, is to operate it profitably by promoting optimal utilization of the installed capacity. At this stage, it is also necessary to look for opportunities of growth and diversification .

Thus it becomes necessary to take recourse to every available modern management technique to achieve the implementation objectives. The dimension of the problems faced at this phase can be brought out by first discussing the tasks of the project manager in the implementation of. A project and the usual problems in implementation.

The project manager's tasks can be divided into four categories (I) technical, (2) personnel, (3) administrative, and (4) external relations (Figure 10.1). The tasks relating to the technical aspects are planning, scheduling of work, setting of priorities, task identification, looking into the logistics, and specification of equipment use. The personnel aspect involves building. Up of organization and recruitment of staff as per the requirements, leading and motivating the staff to perform, building communication channels, resolution of conflicts, conducting negotiation with various parties, and performance evaluation. Administrative tasks include estimating and con- trolling of costs, budgeting, cash flow monitoring, devising and using tile management information system, evolving systems and procedures for various operations including the procurement of raw materials, and finally the terminal project evaluation. The project manager has also to manage the external relations of the unit. These tasks include relations with financial institutions (both term lending institutions and commercial banks), contracting and using the consultants (if required), dealing with suppliers and sub-contractors, and coordination with other agencies including government agencies.

The Project Manager	→	Technical Aspects
		Personnel
		Administration
		External Relations
Technical Aspects	→	Planning, Scheduling
		Setting of Priorities
		Task Identification
		Logistics
		Equipment Use and Schedules
Personnel	→	Organization and Staffing
		Leading and Motivating
		Communication
		Resolution of conflicts
		Negotiation
		Performance Evaluation
Administration	→	Estimating and Controlling Cost
		Budgeting
		Cash Flow Monitoring
		Management Information System
		Systems and Procedures
		Terminal Project Evaluation
External Relations	→	Relation with Financial Institutions
		Contracting and Use of consultants
		Dealing with Suppliers and Sub-Contractors
		Coordination with other Agencies

Fig. 5 : Tasks of the Project Manager in Pre-Operation and Operation Phases

All the above mentioned tasks of the project manager need to be performed at both pre-operation and operation phases of an unit. The nature and complexity of these tasks are, however, different in the operation phase as compared to the pre-operation phase. In the case of turnkey contracts for procurement and erection of plant, machinery and buildings, usually the organizational structure in the pre-operation phase is very sketchy and monitoring involves only the review of programme of work and release of money as per contract.

Problems in Pre-Operation Phase

The most important problem faced in the implementation phase of the project is delay in the execution of projects. It has been observed that as many as 95 per cent of the projects taken up by the public sector could not be completed in time and sometimes delays were even more than 50

percent of tile time in which a project was expected to start functioning. The problem of delay in the project management terminology is also referred as the slippage of projects. The slippage of projects results in escalation of costs and also the losses of revenue, and thereby making the initial assumptions made in the feasibility report completely out of line. The delays are generally caused by two main factors delays caused by internal factors and delays caused by external factors (see Figure 10.2)

Delays caused by internal factors

The delay is often caused by the inadequate work at the planning stage resulting in the preparation of feasibility reports based on wrong and inadequate information. If the feasibility report is not comprehensive enough or based on ideal conditions, there are bound to be problems in executing the project. The project implementation also gets delayed if there is a lack of coordination among various components and departments involved in the implementation of the project. Very often when there are several departments (authorities) involved in implementing the project, it suffers due to their different attitudes to the project with different conditions under which they perform without interlinking the combined sense of accountability to the final completion of the project. For example, very often there are situations when the machinery has been delivered at the site but the civil works, which are being executed by another department or another contractor, are not ready.

Apart from the problems of planning and coordination of work the delays are also caused by lack of delegation of adequate authority to the lower levels of the organization which are actually involved in implementing the work.

Sometimes overemphasis on accountability and legal propriety of expenses cause delays. The process of decision making in the pre-operation phase gets delayed because the accountability is not simple, clear, and effective at all levels of the organization so that it can cope with other factors causing delays in implementation.

At the pre-implementation phase, the delays are caused due to selection of contractors who have inadequate experience or who are incapable of handling such a project. In most of the contracts, terms and conditions are not laid down in clear language which pro-vides enough room for disputes at later stages causing stoppage of work at a crucial point upsetting the entire process. Contract documents do not include the realistic terms and conditions as per requirements of the project, schedule of construction of different phases, and other sub-contracted jobs. Of course, delays also occur in preparation of the contract document, selection of contractors through tenders, and signing of contracts.

Delays caused through external factors.

There are several factors which are not under the control of the project manager and which contribute to the delays. For example, the supply of machinery on the site, raw materials equipment, or any other inputs needed as per the programme of construction or installation of mechanical or electrical systems often lead to the delay in the projects. Some of the delays in the supply schedules are very difficult to envisage at the time of the preparation of a feasibility report. There is also a problem of time gap between the submission of project proposal and final approval by the financial institutions, government, and others.

The delays in the supply of machinery and equipment at the site are also caused by the delays in the transportation process involved in the movements of supply of goods. Even the release or delivery of consignment from railways is not very smooth. Non-availability of wagons, rakes, and the man-made scarcity of wagons are some of the important crucial factors causing the slippage of new projects. These are further aggravated by the complicated and lengthy procedure of imports, issue of licenses, clearance, supply of steel and cement by various agencies, etc.

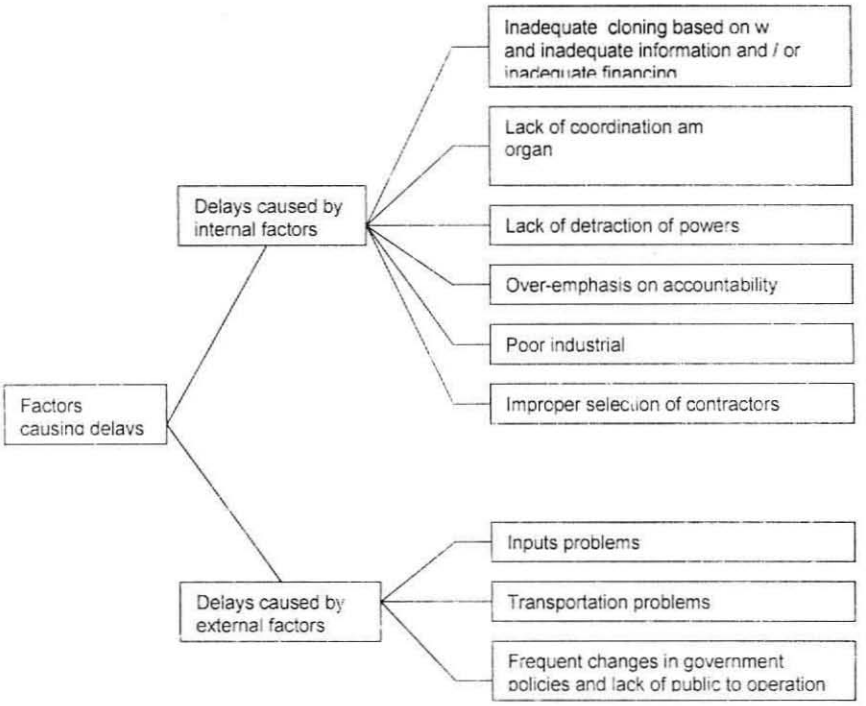


Fig. 6 : Delays in Project Execution

Problems in the operations of a unit

After completion of the pre-operation phase, the unit became operational. Units, particularly agro-industrial units, face several problems in their operations. While some of the problems can be traced back to faulty project formulation, others arise because of internal working of the project or change in the external environment.

Some of the usual problems based on the experiences in Gujarat are analyzed below and are summarized in Figure 10.3.

Faulty Project Formulation and Implementation. Faulty project formulation and handling in the pre-operation phase leads to problems in the operation phase of the project. Faulty project formulation can often be traced back to faulty product selection, doubtful financial viability and wrong location which would lead to problems in using the installed capacity. The problems caused by faulty project formulation and implementation often require additional financed nursing of the units.

Non-Availability of Raw Materials. In the case of agro-industrial projects, raw materials constitute a very substantial portion of the cost of production. Therefore, any problem in procuring raw materials at a reasonable price leads to a situation of under- utilization of capacity, higher breakeven capacity, and lower profitability unless the output prices can also be changed accordingly. Again the output prices of many agro-industries are under government regulation and control which make it difficult to after the output prices in proportion to cost escalation. For example, one can look into the case of a very modern fishmeal plant at Mandapam in Tamil Nadu. The plant was set up to use low priced fish (silver bellies) as raw material. Subsequently, silver bellies became extremely expensive (because of direct edible use) to be used in a fishmeal plant. Therefore the plant cannot now get adequate amount of raw material and unless some alternative source of cheap fish can be found, there is hardly any hope to revive the plant.

Raw material problem may also arise because of a change in government policy with

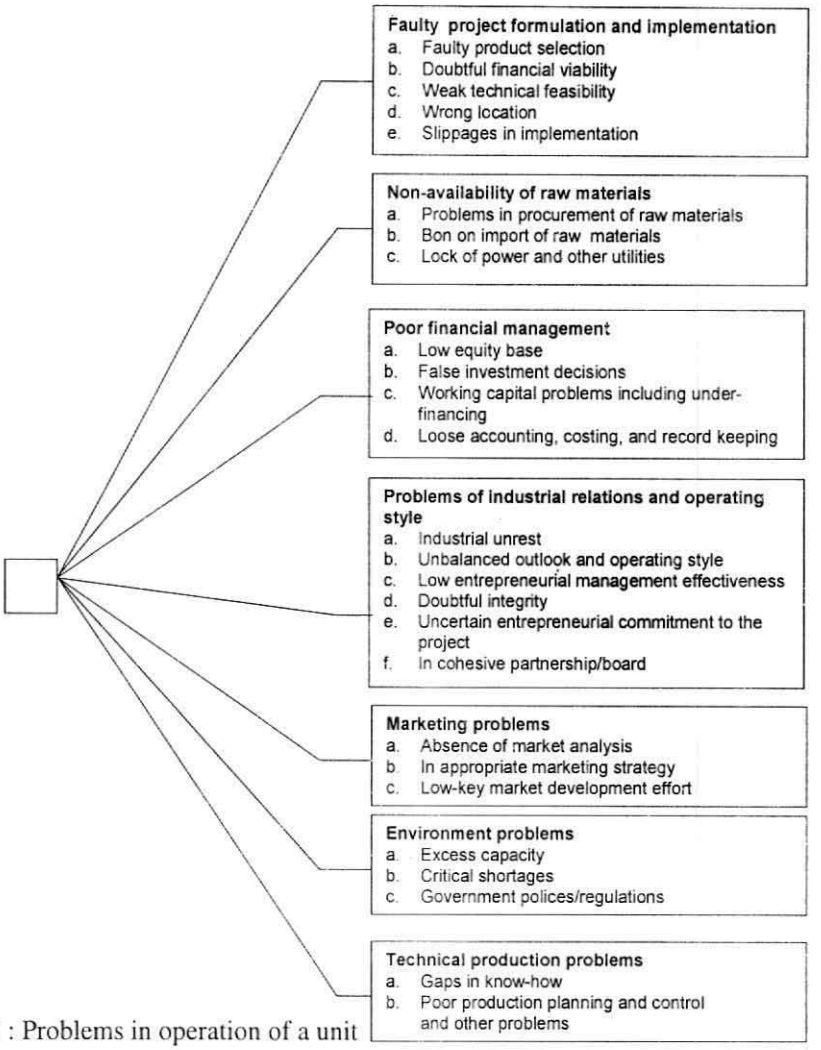


Fig. 7 : Problems in operation of a unit

respect to imports of those materials. Apart from raw materials, power cuts and lack of other utilities also cause problems in utilization of installed capacity. If an industry uses continuous process, much time is lost in putting the process back into operation after the power cut.

Poor Financial Management. Problems arising out of poor financial management can be usually traced to low equity base, false investment decisions, working capital difficulties, loose accounting, costing, and record keeping. Although the debt-equity ratio and promoter's contribution requirements have been considerably liberalized (as discussed in Chapters 7 and 8), in practice entrepreneurs need higher equity base to at last tide over unforeseen cost escalations. In the absence of such a base, even managerial cost escalations create problems for functioning of the unit It has also been observed, particularly in the case of agro-industrial units, that working capital requirements are not anticipated and forecasted well. Therefore, commercial banks grant the working capital limits which are not sufficient to take care of various production and marketing requirements. When the unit begins to face the constraint of working capital, production suffers. Bankers became reluctant to grant additional limits. The unit then gets into the vicious circleLack of project accounting, costing, and record keeping makes the cost control and pricing decisions difficult, leading to financial problems. This is observed more so in the case of several agro-industrial units where there are no

qualified accountants. Once the problems crop up, banks begin to ask for various kinds of data which is difficult for these units because the data simply do not exist in that form.

Problems of Industrial Relations and Operating Style. Industrial parce and worker's cooperation are key factors in realizing production build-up as anticipated. Units get into difficulty in early stages because of labour problems. Some of the labour problems can be traced to the operating styles of the entrepreneur and lack of managerial effectiveness. Sometimes promoters themselves do not operate as a cohesive group. There are cases where doubleful integrity and entrepreneurial commitment to project on the part of promoters cause problems for operating the unit profitably.

Marketing Problems. Many small scale and agro-industrial units face problems in marketing their products. Some of these problems can be traced back to inadequate market analysis at the project formulation stage. Other marketing problems arise because of inappropriate marketing strategy and or low-key market development effort. Some or the agro-industrial products require longer gestation periods than initially expected in developing the tastes and clientele. For example, one can take the case of soyabean based products or cottonseed oil for edible purposes.

Environmental Problems. There are problems that arise from changes in external environment faced by the unit. These changes arise because of changes in government policies and/ or critical shortages of raw material and utilities. For example, time to time serious shortages of coal and power cuts cause problems for production. Ban on movement of final product also creates problems in realizing the remunerative prices and, therefore, problems of capacity get aggravated..

Technical Production Problems. Very often, particularly in the case of indigenously developed technology, problems arise in the process of expanding pilot plants to commercial scale units. The know how is not fully technically foolproof. In the case of imported know how also, shortage of spares and critical equipment break. Downs cause production breakdown. Without appropriate production build-up, a whole host of problems discussed above arise. Sometimes the technical production problems can be traced to the improper scheduling and monitoring of production. This aspect can also be linked with lack of managerial effectiveness. One can think of the example of furfural production units in the country. It was found that the digesters corroded much more quickly than envisaged and thereby wiping out a large chunk of equity and causing serious problems for survival of units.

Tasks in The Preparation of Operational Plan

While the feasibility report includes information on the organizational structure and time schedule for the implementation of the project and phasing of the production build-up, it is to be made more precise to facilitate the implementation process. The implementation process is facilitated by breaking down the overall objective of the project into various sub-objectives and these objectives themselves into successive activities and sub-activities. Therefore, the first task in the pre-operations phase is to identify the whole set of activities to be carried out and the identification should be such that the activities are as homogenous as possible. The activities thus identified need to be put in a time-frame such that the entire work of the project could be divided into sub-jobs with a clear picture of all activities and sub-activities. For that, the responsibility of each small or big activity need to be clearly laid down and defined to avoid confusion. Thus, the manager needs to operationalize the organization chart presented in the feasibility chart by linking the activities according the administrative responsibilities from various executives in the organization.

Despite all the care, there are bound to be factors beyond the control of the manager and which are likely to cause delay in the project implementation. Therefore, it is necessary to build a system which can correct any deviations from the initial expectations and see to it that no factor, whether internal or external, is allowed to disturb the schedule of the project under any circumstances. To perform such task, there needs to be a scientific system of flow of management information to

the executives at various levels in the organization who are performing various tasks. The system of monitoring and control is more effective when along with the time-frame, there is a linkage between the physical work to be performed in each activity and the financial expenditure to be incurred. This helps in preparing a time table of financing and regulating the availability of financial resources given the time schedule; for various activities.

Very often the task of completing the civil works and installation of machinery on the site is given on turnkey basis to the contractors. Even then, the implementation aspects have to be thought and analysed so that the contract terms may be accordingly defined where the project management staff is able to follow the progress and take remedial action. Thus, the operational plan should include the following aspects

(1) The breakdown of the project's final objective into various subobjectives and these objectives into activities and sub- activities.

(2) The time schedule for starting and completion of each activity and sub-activity and their sequencing.

(3) Linking of physical work involved in each activity with financial expenditure.

(4) The time table indicating the requirements of financial resources during the pre-implementation phase.

(5) The monitoring and control system to assess the following

- What has already been done ?
- What remains to be done ?
- Where are the shortfalls likely to occur and what remedial actions are required ?
- Who does what ?

The operational plan should also contain information on procurement system of raw materials when the unit becomes operational. As discussed in Chapter I, raw material accounts for the bulk of input costs in agro-industrial projects and the success in procurement operations determines capacity use and production build-up in the operational phase. Therefore, this is a crucial aspect. Procurement system includes not only the organizational set-up but also the specification of the sources, timing, quality and prices; etc.

Management Techniques for Effective Control

Since general experience indicates a very widespread problem of slippage in the completion of projects, it becomes necessary to use modern project management techniques in preparing and using the operational plan for the implementation phase. In identifying activities and sub-activities and in sequencing and time scheduling programme evaluation and review technique (PERT) and critical path method (CPM) are extremely useful. In linking the physical work and various activities with the financial expenditure, performance budgeting technique has been found to be useful. The management control systems as well as management information; systems are useful in monitoring and review of the progress of the project and in identifying the shortfalls and initiating remedial actions. Certain considerations in designing the procurement system based on the experience of a number of agro-industrial units are useful in building the procurement sub-system of the project under consideration and finally when the project becomes operational the project cycle has to be repeated in the form of looking for opportunities of diversification and growth. All these techniques are elaborated along with appropriate illustrations from agro-industrial projects in subsequent chapters.

*The author's acknowledges U.K. Shrivastava, Project Planning, Financing, Implementation and Evaluation with special reference to Agro Industrial Projects, CMA, Ahmedabad 1981 for the source.

CHAPTER 13

ECONOMIC ASPECTS OF PROJECT EVALUATION

Introduction

In ranking fisheries projects and assessing the socioeconomic objectives of the projects, a realistic attempt is necessary through adoption of appropriate methodology. UNIDO Method [1978] suggests that all the items, i.e., costs and benefits involved in the projects are to be valued in terms of percent aggregate consumption. Considering the market prices, which are inadequate in reflecting the real social costs and benefits of the projects, the goods and services are to be valued in terms of shadow prices, which indeed, reflect social costs and benefits.

Costs and benefits

In project analysis, the objectives of the analysis provide the standard which costs and benefits are defined. Simply put, a cost is anything that reduces an objective and a benefit it anything that contributes to an objective.

Cost benefits analysis is a practical way of appraising the desirability of a project involving public expenditure in terms of net social gain to the society. The principle concern of the analysis is to enumerate and evaluate all the relevant costs and benefits of a project from a social point of view, particularly when there do not coincide with the financial cost and benefits.

Genesis and development of the concept

As early as 1844, Jules Dupuit, often described as the intellectual father of cost benefit analysis, while seeking a criterion of the value to society of public works, such as roads, canals, bridges and water works pointed out the weakness of calling the value of a thing only what is paid for it since many users would, if necessary, pay more than that they actually do pay. This is essence, was the concept which later on came to be known as the consumer surplus. The concept was really developed by Marshall and later on modified by Hicks, Kalder and others.

Method of evaluation of costs and benefits

In the methods of project evaluation, the usual stages are,

1. The description of technical and economic characteristics of each project.
2. The estimation of the influence of the project on the economy, both during the construction period as well as during the operational period, when the investment is completed and the newly productive capacity is in operation.
3. Evaluation of project consequences that may be direct of indirect importance.
4. The formulation of criterion for the selection of the projects.

Estimation of costs and benefits on the basis of benefits

A project is beneficial to the extent it tends to increase the income of the people, in income being measured by the actual increase in the production. Benefits may be real or nominal, direct or indirect and tangible or intangible.

Estimation of costs and benefits on the basis of costs

Just as there are various forms of benefits so there are various types of costs. These include project costs, associated costs, real or nominal costs, primary or direct costs and indirect or secondary costs.

Essentially, cost-benefit analysis purports to be a way of deciding what society prefers. Where only one option can be chosen from a series of options. CBA should inform the decision-maker as to which option is socially most preferred.

The various parameters involved in cost benefit analysis are as follows

1. Social rate of discount
2. Shadow price of investment
3. Shadow price of capital
4. Shadow price of labour
5. Shadow price of foreign exchange and
6. Income distribution weights that are proxies for regional income Differentials.

The National Planning Agencies and concerned project authorities specify the estimates of these parameters.

Social Rate of Discount [SRD]

There is a time lag between the investment and the returns from the fisheries projects, which is termed as "Gestation period". As a result, different values are to be attached in the economic analysis of the project, particularly to costs and benefits. The present value of the future benefits or costs [called discounting] depends on the magnitude of social rate of discount and this considerably brings about change in the values of costs and benefits. For instance, a higher social discount rate will reduce the net present value of the benefits or costs and vice-versa. Hence, the choice of appropriate social rate of discount [SRD] is of vital importance, especially in fisheries projects where there is a long gestation period.

SRD is used in computing the Benefit-Cost ratio [BCR], Net Present Worth [NPV], Internal Rate of Return [IRR] etc, of the project. It is the opportunity cost of the capital which just reflects the choice made by the society as a whole, between the present and future returns and hence, it represents the approximate amount of total income, the society as a whole is willing to save over time. Finding out the correct discount rate entails many problems. The controversy arises because the discount rate is required to solve two problems-

1. Proper allocation of resources between the public and private sectors.
2. The allocation of resources between the provision of present and future goods and services. The rate used to solve the second problem is called the social rate of discount or social time preference rate.

The social rate discount is the premium, which the society puts for preferring the present consumption to future consumption.

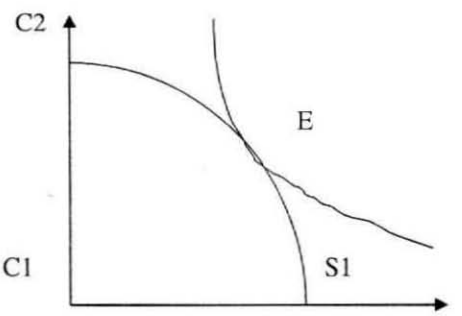


Fig. 8 : Social Rate of Discount

This figure explains in terms where the present consumption C1 is taken on horizontal axis and the future consumption on vertical axis. C1C2 is transformation frontier or investment possibility curve. It consists of series of projects arranged from right to left in order of their rate of return, the cost is the sacrifice of present consumption and the return is the gain of consumption in future. The society will choose from the various investment possibilities so as to reach its highest social indifference curve S1. The society reaches an optimal position with regard to its sacrifice of present consumption and invests it for gain in the future consumption when its transformation curve C1C2 equals its social indifference curve S1 at point E. It is to be noted that the slope of the transformation curve represents the rate of return on investments and the social indifference curve represents the rate of time preference. So that the social discount rate is determined with the equality of the rate of return on investment and the rate of time preference at point E.SRD evaluated on the basis of benefits and costs.

In practice by rule of thumb an approximate and agreeable social discount rate is adopted in the economic analysis of the projects. The popular choice is 12 percent discount rates and in some countries, is in the evaluation of fisheries projects it varies from 8 to 15 percent. The factors that determines the social rate of return are-

Society's present level of consumption,

ii. Expected growth of consumption,

iii. Expected growth of population,

iv. The marginal utility of consumption and

Pure time preference.

SRD values can be estimated by using the following expression,

$$SRD = (1+g)^{-e} - 1+PTP$$

Where,

g is the growth rate of percapita consumption,

e is the elasticity of diminishing marginal utility of consumption and

PTP is pure time preference.

Shadow Price

Need for the use of shadow prices The price mechanism operates imperfectly in underdeveloped countries. Market prices do not correctly reflect relative scarcities, benefit and costs. This is because perfect competition is entirely absent; structural changes do not respond to price changes; institutional factors distort the existence of equilibrium in the product, labour, capital and foreign exchange markets; and prices fail to reflect and transmit the direct and indirect influences on the supply side and the demand side. Markets are not in equilibrium due to structural rigidities. Labour cannot be usefully employed because of the shortage of other cooperate factors. The rate of interest understates the value of capital to the economy. And disequilibria persist in the balance of payments, which cannot be reflected in the official rate of exchange.

For instance, in such economies wages are much lower in the non-organized aquaculture sector while they are even higher than the opportunity cost of labour in the industrial sector where labour is organized in strong trade unions. In the capital market, the market rate of interest is much higher than the bank rate, and the current rate of footing exchange is much lower than in the black market.

Demand and Supply of Water

In Fig.9, the supply and demand form water is taken on the horizontal axis and price on the vertical axis. In the initial accounting period, OQ1 quantity of water is needed by the farmers of the area. But the government is supplying OQ2 quantity of water from the irrigation project at OP1 price. In the next accounting period, the government may set the price equal to marginal cost or charge the price of irrigation water too low as part of it's strategy of regional development. After the low price OP2 is charged by the government, the demand for water will exceed the supply. In such a case the government may adopt the policy of rationing of water, it may ask each farmers to limit their ponds for water supply In the next accounting period, the government uses Ops as the shadow price which is the equilibrium price when Oqs of water is supplied and demanded.

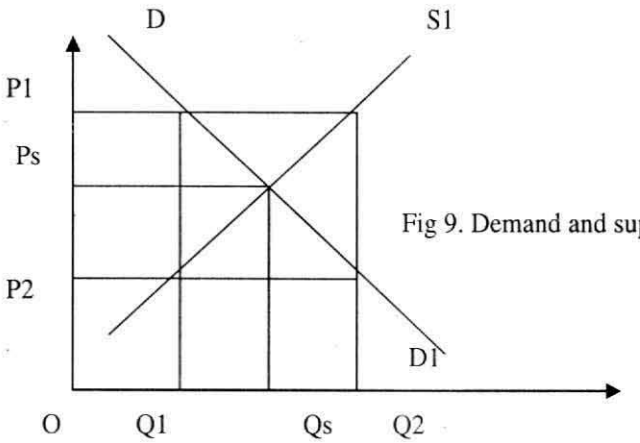


Fig 9. Demand and supply of water

Thus "market price particularly those of the factors of production, form a very imperfect guide to resource allocation in underdeveloped economies; there exist fundamental disequilibria which are reflected in the existence of massive underemployment at present levels of wages, the deficiency of funds at prevailing interest rates and the shortage of foreign exchange at current rate of foreign exchange." To overcome these problems, the use of shadow prices has been suggested by economists for the allocation of resources in development, planning, for evaluating projects and as a device in programming. To conclude with professor Streeten, "the call for the use of shadow prices (or accounting prices) in planning for development stems from the obvious fact that actual market prices do not reflect social benefits and social costs. Some are fixed by administrative fiat. Others are free, but influenced by quantitative controls. The shadow price is the price which would prevail if prices were equilibrium prices".

Meaning of Shadow Prices

Shadow prices reflect intrinsic or true values for factors or products. J.Timbergen defined then for the first time in 1954 in these words. "Shadow prices are prices indicating the intrinsic or true value of a factor or product in the sense of equilibrium prices. These prices may be different for different time periods as well as geographically separate areas and various occupations (in case of labour). They may deviate from market prices". In 1958, Timbergen diffident shadow prices as those that correspond to intrinsic values and "that would prevail if; I) the investment pattern under discussion were actually carried out; and ii) equilibrium existed on the market just mentioned (i.e., labour, capital, foreign exchange markets)". This definition is clear and exhaustive but is silent about the behavior of accounting prices over time.

Shadow prices are other wise known as accounting prices. These are subjected to criticism and controversy. In the financial analysis of the projects usually market prices are considered, but, in the economic analysis, true value of the prices is indeed. This is due to imperfect market situations in the economy. If the economy operating in a perfect market situation, the market prices are considered to be true values. If not, there will be bias in the goods and services and the economic analysis of the project becomes erroneous.

For example, if the foreign exchange is done compared to the market prices of economy, there will be an error tending to favour the project with high import content. If the wages are high in the market, capital-intensive projects are favoured over labour-intensive projects.

To avoid such error in the economic analysis of the projects, we generally use shadow prices in place of market prices to reflect the true values of commodities. Hence, in the project analysis there is a need to compute shadow prices for foreign exchange, labour, capital etc.

Determination of cost prices

It can be determined by the
i. General equilibrium or
ii. Partial equilibrium analysis.

General equilibrium method

In the general equilibrium method, equilibrium is established among all the factors by taking their final supply and demand. For this the data relating to the different sectors of the economy are collected and the accounting price of every factor is expressed in algebraic symbols, and added up for the whole economy. A number of simultaneous equations are required to be solved for which correct and adequate data are not available. Since the shadow price is the price that would prevail if prices were equilibrium prices. The existence of full equilibrium is essential for the establishment of an equilibrium price for every factor or product.

The evaluation of shadow prices can be done in two ways, one by trial and error, and another by a systematic method. If the method of trial and error is adopted the evaluation of accounting prices may be based on arbitrary values for products, factors and foreign exchange, calculating the priority figures for all investment project and finding out whether equilibrium has been attained in the markets or not. If this method prevails, a systematic method is required which consists "in introducing algebraic symbols for each of accounting price, trying to express supplementary demand for factors and supply of the product concerned, and then equating total demand to total supply".

Partial equilibrium method

According to partial equilibrium method, the shadow prices of capital, labour and foreign exchange are determined separately. This is therefore, a simple and correct method of determining shadow prices. We will discuss below the determination of the shadow prices of capital, labour and foreign exchange.

Shadow prices of investments (savings)

Shadow prices of investment are defined as the present value of additional consumption generated by additional unit of investment in a project.
Shadow prices are worked out by the following formula,

$$I = \frac{(1-a)\,r}{(I - a\,r)}$$

Where,

I = shadow price of investment

I = social rate of discount

r = opportunity cost of the capital and

a = rate of reinvestment.

Shadow price of labour

It is also called shadow wage rate. Fisheries projects require large number of skilled, semiskilled and unskilled labour during their implementation. Assessment of employment of labour is one of the objectives of the projects. In order to assess the employment levels, shadow wage rates are considered against the market wage rate of labourers. In labour surplus economies, the wage rates are not equal to social opportunity cost of labour.

The following factors are to be considered in working out the social opportunity cost of labour.

(i) The output, foregone elsewhere in the economy as a result of employing labour in the project.

(ii) Cost of migration, training and additional consumption, when a labourer is moved from rural area to project site.

(iii) The potential difficulty encountered by the labourer in finding out a new job in the new area.

(iv) The cost in terms of increased aggregate consumption due to increased employment in the project.

Using all these factors the shadow price is worked out by employing the following formula,

$$SWR = m + s\,(I\text{-}1)\,W.$$

OR

$$\frac{SWR}{W} = \frac{m}{W} + S\,(I\text{-}1)$$

Where,

SWR - is the shadow wage rate. M-is marginal product in present employment (or in the alternative employment when viewed in context of the project).

W - is the market wage paid to a labourer in a new job (Aquacultural operation or constructions).

S - is the rate of savings from profits and

I - is the accounting price of investments.

If the commodities produced in the project area are tradable, their values are to be worked out using shadow prices, which are in turn based on the CIF and FOB prices of the imported and exported commodities respectively.

Determination of shadow price of capital

If the capital is scarce in an economy, where the projects are proposed to be implemented, a general practice of including borrowing rate of capital, in the project analysis does not appear to be realistic and rational because, the burrowed capital must reflect the opportunity cost of capital. To do so, shadow prices of the capital are to be considered in the economic analysis of the projects.

To determine the shadow price of capital or accounting rate of interest, it is essential to

study the factors, which influence the demand and supply of capital. But in underdeveloped countries, the knowledge of these factors is imperfect. Moreover, there is little relationship between the supply of capital and the interest rate prevalent in such economies. There is wide disparity between the prevailing interest rates in different regions and areas. As such, the accounting or shadow rate of interest can be estimated in the basis of the interest rates paid by the private investors. But while so doing, it is essential to make allowance or allow discount on different types of loans for differences in risks involved. In the UN Manual of Economic Development Projects, the following formula has been used for calculating shadow prices of capital.

$$\text{Social return to capital used in the sector} = \frac{\text{Value of output} - \text{cost of materials, depreciation \& labour}}{\text{investment}}$$

In this, the cost of materials, labour, foreign exchange and other inputs are valued at accounting prices and to calculate the return on capital invested (rate of interest), these cost are deducted from the value of output. Thus the accounting price of capital can be known for a sector. Tinbergen opines that it is better to take a higher price of capital than interest rates at which limited sums can be borrowed under certain conditions in the underdeveloped countries. He therefore, suggests an interest rate of 10 percent for underdeveloped countries on the plea that even some of the developed countries were having an interest rate of 7 to 8 percent till recently, where as personal loans are being made now at an interest rate of 25 to 30 percent in the former.

There exists numerous difficulties in estimation and are mainly in underdeveloped countries these are as follows-

First, to base the shadow rate of interest on what is pad by private investors understates the value of capital to the country because an integrated development program may raise the interest over the long run.

Second, the calculation of the marginal product of capital as the basis of the shadow rate of interest for the whole economy is not easy as the projects of higher and lower capital intensity are started, and there is considerable waste of capital in substituting capital for labour in moving things about, in the handling of materials inside the factory, in packaging, in moving earth, in mining, in building and construction, and their failure to develop an appropriate technology in keeping with their factor endowments.

Third, in the shadow rate of interest 'double index number ambiguity' is present which makes its use somewhat dubious. The rate of interest in both a stock and flow concept. The shadow rate of interest is thus not a single measure but is concerned with relations between stock and flow. Infact, in developing economy there is a very large variety of stocks with different degrees of durability. Thus the calculation of the shadow rate of interest becomes very complicated and ambiguous. However, the appropriate formula for the calculation of the shadow rate of interest for the economy is,

$$R = \frac{G}{S_D + \frac{1 - Py}{Py} Sw}$$

where, R is the shadow rate of interest, G is the rate of growth, S_D is the share of profit in total income, and Sw is the saving rate of the wage earners.

Assuming G= 5%, S_D = 25%, PY = 50% and Sw = 5%,

$$\text{The shadow rate of interest (R)} = \frac{5}{0.25 + \frac{1-0.5}{0.5} \times 0.05}$$

$$= 16.6\ \%.$$

Determination of shadow price of foreign exchange

If any country faces the balance of payment (BOP) foreign exchange becomes scarce for that country. Under such situation the official exchange rate does not reflect true value of foreign exchange earned or spent. In order to get real foreign exchange impact on EXIM policies, it is important to make adjustment by using shadow foreign exchange rate. Also import tariffs and subsidies have the same effect on foreign exchange rate, as would consumption taxes and subsidies on the price of a non-tradable. Similarly, export taxes and subsidies have the same effect on foreign exchange rate as production taxes and subsidies. To account for these and other effects on the price of foreign exchange, the economic or shadow exchange rate is used.

The SER is the weighted average of the demand price of foreign exchange paid for by the importers and the supply price of foreign exchange received by the exporters. The relation between OER, foreign exchange premium [the percentage difference between SER & OER], SER and SCF are given below.

$$\text{OER} \times [1 + \text{Fx premium}] = \text{SER, and}$$

$$\frac{1}{+\ \text{Fx premium}} = \text{SCF,}$$

so that Squire and van der Tak[1975] note,

$$\text{SER} = \frac{\text{OER}}{\text{SCF}} \quad \text{and} \quad \text{SCF} = \frac{\text{OER}}{\text{SER}}$$

Shadow rate of foreign exchange is also calculated by using following formula (UNIDO, 1978).

$$\text{SER} = \text{OER} \frac{(M + Ti) + (X + Sx)}{(M + X)}$$

where,

SER is shadow exchange rate, OER is official exchange rate, M is C.I.F values of imports, X is the F.O.B values of exports, and Sx is Export subsidies (export subsidies treated as negative subsidies).

The shadow price foreign exchange is essentially for underdeveloped countries suffering from balance of payment (BOP) difficulties. An artificial equilibrium is achieved in balance of payments by fixing a higher shadow rate of exchange than the official rate of exchange. "In optimum developed plan the shadow prices of foreign exchange would be equal both the incremental cost of earning foreign exchange through exports and to the cost of saving foreign exchange through import substitution.

Example, for foreign exchange through exports.

The weight attached to the cost of foreign exchange is 30 percent higher than its market value; the effect of a project on the BOP should be given a weight of 0.3 in addition to the effect of national income. This is equivalent to valuing all foreign exchange cost and earnings at a price of 1.3.

Accounting prices of foreign exchange is estimated by this way. Israel is the only developing country adopted this method. (Project Analysis in Relation to Planning in a mixed Economy)- I.M.D Little.

A single shadow rate of exchange cannot be applied over time. It will have to be reviewed and raised at different points of time on the basis of the **'black'** and **'free'** 'rates of exchange because the market for some important international currencies like the dollar is imperfect.

The calculation of shadow rate of foreign exchange based on the 'black' and 'free' rates of exchange. If the official (free) exchange rate is Rs. 50 a dollar and the black rate is Rs. 80 a dollar and the conversion of the official rate is four times as great as that at the black rate, then the shadow rate would be the weighted average.

$$\text{i.e.,} \quad \frac{4x50 + 1x80}{5} = 56$$

It means Rs. 56 per dollar would then be the most serviceable shadow rate instead of the official rate of Rs. 50.

Conversion Factors

For the valuation of Economic costs and benefits of any project, conversion factor plays a vital role along with the Role of world prices, economic prices of the traded goods and services, economic prices of the non-traded goods and services, economic prices of labour, economic prices of the land etc. Conversion factors can be calculated and used when testing the economic viability of a project.

Conversion factors are used to convert financial prices to economic values and vice versa. Any conversion factor is the ratio between the economic price of a good or service to its financial price.

$$\text{i.e.} \quad \text{conversion factor} = \frac{\text{economic price}}{\text{financial price}}$$

For e.g., the World Bank uses the following formula to determine the SCF

$$SCF = \frac{X+M}{[X+Sx]+[M+Tm]}$$

where,

X - FOB values of exports at the OER
M - CIF values of imports at OER
Sx - Export subsidies
Tm- Import duties

Conversion factor can be calculated for

- Specific project item, for example the main outputs and inputs, for e.g. land, labour and capital.
- Groups of typical item, such as petrochemicals or any food grains.
- The economy as a whole, as in standard conversion factor.

Specific conversion factor can be calculated to convert financial values into economic values using domestic market price numeraire or the world market price numeraire.

Where the domestic price numeraire is being used, no adjustment for economic value is necessary for the outputs or indirectly productive projects, where an economic value has been attributed based on the willingness to acceptor willingness to pay compensation or for non-traded inputs in the same way.

Conversion factors for groups of products, as well as the SERF (shadow exchange rate factor) and the standard conversion factor are often estimated using only an adjustment for net trade taxes. This approach generally underestimates the difference between the domestic market and border price equivalent values. The corresponding group conversion factors are minimum estimates, together with the SERF, using the domestic price numeraire or maximum estimates, along with standard conversion factor, using the world price numeraire. Results of economic viability analysis can be tested through higher (domestic price numeraire) or lower (world price numeraire) values of the SERF and the SCF (standard conversion factor) respectively, and the conversion factor for groups of the products.

Several non-traded inputs occur in nearly all projects, construction, transport, waterpower, distribution and financial services are the most obvious. It may be desirable to calculate specific conversion factors for these commodities occurring inputs on a country basis so that consistent values are used across different projects in a country where the supply of these non –traded inputs is being expanded. Specific conversion factors can be calculated through a cost breakdown at financial prices. The cost breakdown should include the proportion of; the financial value spent on surplus labour, scare labour, net taxes to Government., traded items and domestic resources, such as cost structure can be used to estimate a conversion factor for the item if there exists an estimate of the SERF and SWRFs for the different categories of labour, or standard and adjusted SWRFs for the labour categories.

Following table illustrates the importance of the two national parameters, the SERF (SCF) and the SWRF, the SERF and SCF are estimated at the national level, There are different approaches to estimating a SERF / SCF, including the use of semi-input – output methods or an estimate of the sustainable trade balance. The SWRF may differ from project to project for different types of labour should be estimated on a project basis. More over, the opportunity cost of surplus or scare labour in physical terms may differ between projects in one region it may be represented by livestock product. Specific conversion factor for different labour categories can also be used in the above procedure, if they can be estimated.

Table 26: Specific Conversion Factors from Cost Breakdown

Item	Proportion (%)	Adjustment using DPLN	Adjustment using WPLN
Traded goods	60	SERF	1.0
Surplus labour	10	OCSL	OCSL, SCF
Scare labour	10	OCSCL	OCSCL, SCF
Net taxes	10	0.0	0.0
DomesticResources	10	1.0	SCF
Total	100	DMP adjusted	WMP adjusted
Conversion factor		DMP CF	WMP CF

Where,

DPLN - Domestic price level numeraire,
WPLN - World price level numeraire,
SERF - Shadow exchange rate factor,
OSCL - Opportunity cost of surplus labour,
SCF - Standard conversion factor,
OCSCL - Opportunity cost of scare labour,
CF - Conversion factor,
DMP - Domestic market price,
WMP - World market price,

Difficulties in the use of shadow prices

Apart form the certain difficulties already mentioned in the determination of shadow prices for capital, labour and foreign exchange there are other difficulties of a general nature.

i) The calculation of shadow prices presupposes the availability of data. But adequate data are not easily available in case of less developed countries.

ii) In order to establish intensive nature of factor or product requires the existence of full equilibrium in all markets. In an underdeveloped economy, the knowledge of full equilibrium conditions for the entire economy is not possible. Thus the notion of shadow prices corresponding to intrinsic values is arbitrary.

iii) Require complete knowledge of the demand, supply and employment equilibrium.

iv) With regard to time diminution the concept of shadow prices is static and timeless

v) Another paraxial difficulty that arises is the private enterprises buy the inputs and sell output at market prices. The government on the other hand, uses shadow prices for the evaluation of its projects but buys all inputs at market prices and sells outputs at competitive market prices where she does not posses a monopoly.

vi) The determination of shadow prices is difficult in the case of projects with high capital intensity and which are substitute and complimentary to each other. Suppose there are two projects in which the input of one is the output of other, and vice-versa, In such a cases the determination of the accounting prices of labour, capital foreign exchange etc are will not only be difficult but impossible because the decisions about construction plans of the two project cannot be the same.

vii) Often prices of such services as electricity and transport are regulated by the government, and are not fixed on the basis of social opportunity cost.
E.g., prices of electricity used in feasibility studies of industrial projects in many developed countries are derived as an average charge of two-part tariff. Since a two part tariff charges a consumer according to this individual demand, rather than the system peak demand, it will fail to reflect the long run incremental cost (hence the social opportunity cost of electricity).

Uses of shadow prices

Dispute these difficulties shadow prices posses the following uses,

i) In project evaluation

The use of market mechanism for the determination of the product and factor prices is not a perfect and correct method because it leads wrong allocation of resources. In underdeveloped countries, the market mechanism operates imperfectly due to a number of economic and social obstacles. Therefore, it is not possible to have project evaluation on this basis. Even otherwise the run in prices being inevitable during the process of planning, it is therefore not possible to correctly assess the costs and benefits of the project.

Accounting prices are a convenient tool for evaluating investments project in different sectors of the economy. Factor that is expected to be in short supply should have an accounting price higher than its marketed price, while one that is surplus should have a valuation that is lower than its market price.

Thus shadow prices are used for evaluating the effects of a project on the national income, which are also termed as external effects. This is often done on the basis of profitability criterion or cost- benefit analysis where both costs and benefits are calculated at accounting prices.

ii) In public policy

The success of development planning depends on the correct operation of public policy. Shadow prices are intrinsic prices on whose correct determination the success of a plan to a considerable extent. In a mixed economy, the public sector cannot be developed unless the prices of labour, capital, foreign exchange and other inputs are determined in accordance with shadow prices. Though very often-shadow prices are rough estimates, yet the state should try to bring market prices close to the shadow prices of products and factors through fiscal, monitory and other measures for the successful implementation of the plans.

iii) In programming

Shadow prices have the greatest importance in programming. Programming is the working of the economy in a rational, consistent and coordinated manner.

Thus the technique of the shadow prices serves as useful computational shorthand in devising a relatively efficient system of project evaluation and helps in achieving success in programming and public policy.

Conclusion

As professor Myrdal in his 'Asian Drama' regards shadow prices as "utterly unreal and other wordily" in concept, particularly in underdeveloped countries like those in south Asia,.. as it is recognized that they cannot be definitely ascertained.... This abstract and metaphysical concept cannot help to solve the theoretical and practical problems facing South Asian planners. It stands out as a typical example of the pseudo knowledge, given a learned and occasionally mathematical form, that unfortunately has formed a major part of the contribution of the western economist the important tasks of ascertaining the facts in underdeveloped countries and creating a framework for policies designed to engender and direct development.

CHAPTER 14

METHODOLOGICAL ISSUES IN THE FINANCIAL AND ECONOMIC EVALUATION OF FISHERIES PROJECTS

Introduction

This chapter mainly focuses on the differences in approach while evaluating a project economically or financially. Knowledge of the differences between economic and financial analysis is essential for a better understanding of the methodologies involved in these analyses. A financial analysis includes certain items of cost and income to the project, which are not relevant when one looks at the macro-economic benefits. Some major areas with regard to which financial and economic analyses differ –

1. Transfer payments

Transfer payments are so called because they merely shift claims to goods and services from one entity to another and do not reflect changes in national income. There are four kinds of transfer payments

a) Taxes

In financial analysis, taxes are treated as costs and are hence deducted from benefits. But in economic analysis, taxes do not constitute a resource cost to the government are not deducted from benefits.

b) Subsidies

Subsidies are simply transfer payments that flow in the opposite direction to that of taxes. Subsidies are included as a part of the benefit stream when financial analysis is done, since they represent lower input and /or capital costs. However they are not included in the benefit stream in economic analysis because they are merely transfer payments.

c) Loans and their repayment

With respect to loans [credit], both economic and financial analyses are similar. The loan itself and its repayment are not considered as part of the costs because they represent mere financial transfers. The cost of the investment financed from the loan is already reflected when initial investment cost is deducted from the benefit stream. This procedure holds good for working capital also, since input costs financed from such loans are subtracted from the benefit stream.

For e.g. a fish farmer makes a loan to his neighbour. The lending farmer cannot use the money he lends to buy fertilizer, but the borrowing farmer can. The use of the fertilizer is of course, a cost to the society because it uses up the resources, thus reducing the national income. But the loan transaction itself does not reduce the national income; it is rather, a direct transfer payment. In reverse, the same thing happens when the farmer repays his loan. The farmer who borrowed cannot buy fertilizer with the money he uses to repay the loan his neighbour made, but his neighbour can. Thus the repayment is also a direct transfer payment.

d) Debt service [Payment of interest]

The payment of interest by the project entity on the loan is not included as part of the cost when financial analysis is done because this is already considered in the discounting procedure for initial investment. Even in the application of social profitability analysis, the interest payments by

the project entity are not considered as apart of the costs because they represent transfer of project entity to the lender in which no real resource is used.

2. Nature of prices used

In financial analysis market prices are used. However, these prices may not reflect the real scarcity values because the project is not going to be operated in perfect marketing conditions; in developing countries, a market is protected through various governmental measures [export subsidies, import duties, quantity restrictions etc], there will be scarcity of foreign exchange, and hence market prices of goods and services often do not provide a reliable guide to the costs and returns of the projects. Hence in economic analysis goods and services are valued at their shadow prices [also sometimes referred to as open market price/social cost/opportunity cost] to get their real value. For e.g., if there is some statuary price control that keeps the price of fish below what it would fetch in an open market, shadow pricing should be used to give an estimate of what its real value is likely to be. The open market or shadow price thus represents the true economic value of the fish to the consumer.

3. Externalities

Externalities are taken into account into account in economic analysis. These refer to secondary cost and benefits, which are not directly linked to the project. Externalities occur when the economic activities of one enterprise affect another in ways other than the price mechanism. Externalities arise because there are no property rights in certain areas of economic activity for e.g. as in open access fishery where the entry of a new participant is an external cost to the existing fishers. The concept of externalities will be discussed later in this chapter.

A further major difference stems from the foreign exchange premium. This premium is given by the percentage difference between shadow exchange rate and official exchange rate. This premium is in fact, a tax paid by the exporters to the importers.

Apart from these major differences between financial and economic analysis, there are some more differences.

In financial analysis, the discount rate chosen to make the benefit and cost streams comparable overtime is generally the market rate of interest. Against this, economic analysis considers shadow price of capital as the discount rate. In other words, the marginal productivity of additional investment in the best alternative uses in the economy is considered the appropriate discount rate.

Depreciation allowances may not correspond to the actual use of resources, and therefore are excluded from the cost stream irrespective of both types of analyses. These allowances are already taken into account in the initial investment cost less its discounted terminal value.

Reasons for distortions between social and market prices

In most cases, there is divergence between social and market prices. Such divergences are particularly severe for three important resources, labour, capital and foreign exchange [the exact shadow price of each of these inputs has to be calculated at a national level and is usually done by the Ministry of Finance or the Planning Commission]. The reasons for these divergences are briefly given below

1. Imperfect marketing conditions

Here the natural market forces of demand and supply are not allowed to act freely and determine prices because of few buyers or sellers, poor market information, heterogeneous products, no free entry and excess in some cases etc.

2. Indirect taxes and subsidies

Both financial and economic prices are related to market prices. If the government imposes taxes to raise revenues, prices paid by the buyers will diverge from prices received by sellers, as

taxes create a difference between supply and demand prices. For any good, the demand price is that at which buyers are willing to buy i.e. the market price plus consumption taxes, and the supply price is that at which suppliers are willing to sell i.e. The market price less production taxes and plus production subsides.

In conclusion, for project output, the economic price exceeds the financial price by atleast the indirect tax, whereas for project input, the financial price exceeds the economic price by atleast the amount of indirect tax.

3. Government regulations

Even in cases where there are many producers and sellers, prices may be determined by non-market factors. Government regulations will, in many cases, determine prices. Minimum wage legislations and maximum price controls are two common examples of government intervention. Perhaps the most common example of controlled prices is the foreign exchange rate, which is often fixed by the central bank in the country [the RBI in India]. In the absence of tariffs and controls over foreign exchange payments, the fixed rate may still represent the opportunity cost of imports and exports. But all countries use import tariffs and may also employ quantitative restrictions such as import licences and profit remittances quotas. In the presence of such intervention in the exchange market, the fixed exchange rate will diverge substantially from the opportunity cost of foreign exchange.

4. Producer and consumer surplus

Economic and financial values can also differ as a result of producer and consumer surplus. Such surpluses arise from the market impact of projects. For e.g., if a project is large enough to cause the price of the output to fall, the producer surplus is reduced and the consumer surplus of both existing and new consumers is increased. Though both producer and consumer surplus are difficult to quantify, rough estimates can be made, particularly for key project beneficiaries. For e.g., the difference between the financial price of labour and it's economic price is a major source of producer surplus and benefit to the poor.

5. Externalities

External effects can also cause differences between economic and financial prices. Positive externalities are known as external benefits and negative externalities as external costs. For e.g., because of a factory effluent released nearby a hatchery project has to incur additional cost towards water purification [negative externality]. The construction of a railway line near the hatchery project reduces the transportation cost of the fry it produces [positive externality].

In sum, economic values exceed financial values as a result of output taxes, input subsidies, foreign exchange premium, consumer surplus and positive externalities.

Financial values exceed economic values as a result of output subsidies, input taxes, foreign exchange discounts, producer surplus and negative externalities.

Economic evaluation of costs and benefits-Important aspects

The use of constant prices in the economic analysis of projects

Constant price refers to a value from which the overall effect of general price inflation has been removed. When current prices are adjusted for general inflation, it is assumed that inflation will affect the prices of the inputs and outputs in the project to the same extent, such that the prices retain the same general relationship to each other. Using constant prices ensures that the future costs and benefits of the identified project alternatives are estimated in the same units as the costs and benefits at the time the decision to invest in the project is made. For traded items, the appropriate measure of inflation to adopt in adjusting current to constant prices is a measure of international inflation.

For non-traded items, an appropriate measure of inflation is the projected rate of increase in domestic prices measured through a gross domestic deflator, a general consumer price index, or a more specific index, such as a construction price index for construction costs.

Border prices

It is appropriate to consider the costs and values of traded inputs at international exchange rates i.e. border prices, excluding the effects of domestic tariff, subsidies, and other taxes in the economic analysis of projects. The demand price for an exported output its FOB [free on board] price and the supply price for an imported input is its CIF [cost, insurance & freight] price.

Free on Board and Cost, Insurance and Freight prices are typically expressed in local currency terms converted from foreign currency at the official exchange rate [OER]. Non-traded output and input sold in the domestic market are also valued at economic prices but are naturally expressed in national currency at the domestic price level.

To calculate economic FOB & CIF, we first start with their financial prices. The elements of financial CIF & FOB are listed below.

CIF Includes

- FOB at point of export
- Freight charges to point of import
- Insurance charges
- Unloading from ship to pier at port

Excludes

- Import duties and subsidies
- Port charges at point of entry for taxes, handling, storage agent's fee and the like.

FOB Includes

- All costs to get goods on board but still in harbour of exporting country
- Local marketing and transport costs
- Local port charges including taxes, storage, loading, etc
- Export taxes and subsidies.
- Project boundary price
- Farm gate price.

The exact way to convert financial values to their economic values is discussed below.

Adjusting financial prices to economic prices

The financial prices of tangible items can be adjusted to economic value in three successive steps-

1. Adjustment for direct transfer payment
2. Adjustment for price distortion in traded items.
3. Adjustment for price distortion in nontraded items

Simply stating, first the cost of the project at current prices should be ascertained. From these direct transfer payments are eliminated. If constant prices are needed, they are weighted by a price index. Finally, the weighted price is multiplied by the SER in case of traded goods to get the economic values. For non-traded goods, for e.g. labour the respective SCF is used.

Decision tree for determining economic values

The items to be valued may be broadly classified into two tangible and intangible.

Intangible items

These can be identified and quantified but not valued for e.g. the level of education in fishermen's households.

Tangible items

These can be identified, quantified and valued. Tangible items are of mainly two types, those that do not involve real resource use [e.g. direct transfer payments] and those that involve real resource use i.e. traded and non-traded goods and services.

Traded items

These are items that are either exported or imported. Traded items are those for which, if exports, FOB price is greater than the domestic cost of production [e.g. shrimp] and if imports, domestic cost of production is greater than its CIF price.

If a project uses inputs that are imported for the project specifically, then the economic price is its CIF [e.g. a shrimp farm project using imported feed].

If a project produces an output that is exported specifically because of the project, then the economic price of the output is its FOB value.

If the proposed project produces something that can be used in the place of an imported good i.e. if it produces an import substitute, the value to the society is the foreign exchange saved by using the domestic product valued at border prices, in this case, the CIF. For e.g. substituting imported shrimp feed with domestically produced feeds.

But if the project uses items that might otherwise have been exported, i.e. if it uses diverted exports, then the opportunity cost to the society is the foreign exchange lost on the exports foregone, valued at the border price, this time the FOB price.

If we use conversion factors to allow foreign exchange premium, the economic value of a traded item would be obtained by converting the foreign exchange price to its domestic currency equivalent using the OER.

If we use the SER to allow for foreign exchange premium [Fx premium], the economic value of a traded item would be obtained by converting the foreign exchange price to its domestic currency equivalent using SER.

Non-traded goods and services

Goods and services may be non-traded for different reasons. By their nature, some gods and services such as domestic transport and construction are products that must be produced and sold within the domestic economy. Sometimes goods and services maybe non-traded because their cost and quality are such that, although they can be sold in the domestic market, there is no international market. In some cases, non-traded ones have close substitutes which are traded. However, in most cases, there is usually no substitute.

For land, the economic value may be determined based on its opportunity cost which may either be its rental value or purchase price or any other direct estimate [e.g. production from the land.

In case of labour that is fully employed even without a project, the market wage can be taken as its economic value. However, in case labour is under employed without the project, the marginal value product of labour employed without the project i.e. its opportunity cost is taken as its economic value

If a project uses domestic input which been supplied by an industry operating at full capacity, the market price reflects its economic value. In case the input supplying industry has excess capacity [i.e. under asuarin], then the marginal cost of producing the input is used in economic analysis.

If a project output replaces other items in the market, then the economic value of the

output is the resources saved by not producing the other items.

In case of very large projects whose output results in a fall in prices, the economic value is a weighted average of the price with and without project.

In case of a small project in relation to the market, the economic price may be taken as the market price of the output without project.

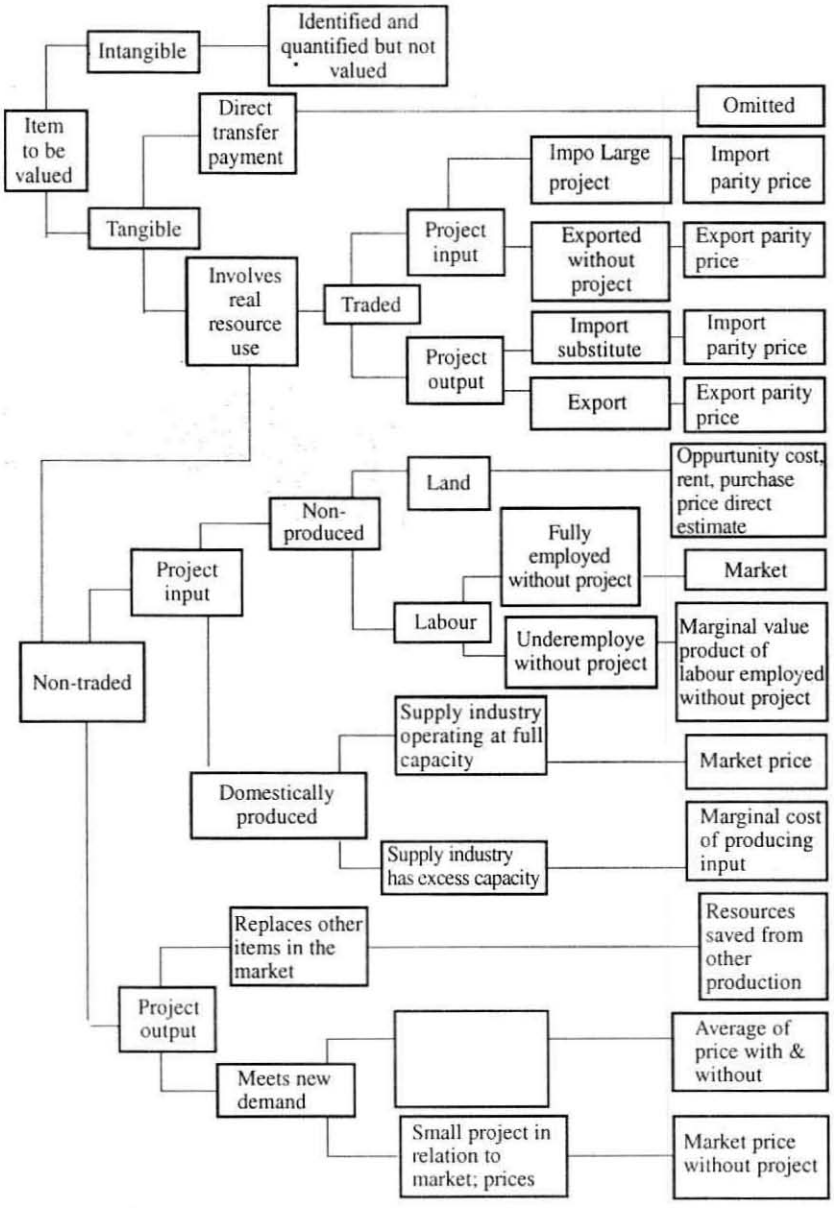


Fig.10: Decision tree for determining economic values

Part - VI

Project Management Techniques

CHAPTER 15

PROJECT MANAGEMENT TECHNIQUES

Introduction

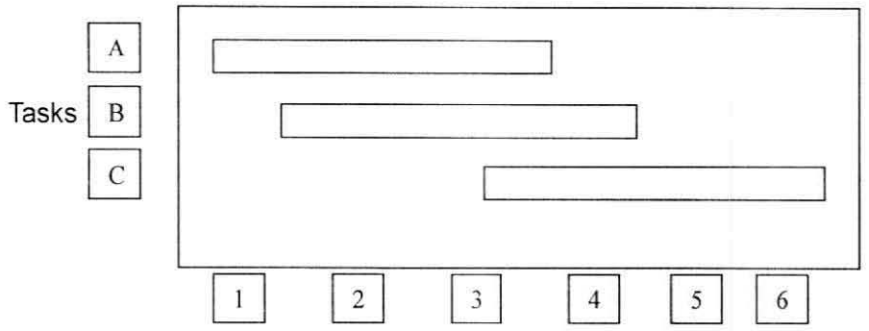
Project management involves decision making for the planning, organizing, coordination, monitoring and control of a number of interrelated time bound activities. Project Manager therefore, often depends on tools and techniques that are effective enough not only for drawing-up the best initial plan but also capable of projecting instantaneously the impact of deviations so as to initiate necessary corrective measures. The search for an effective tool has resulted in development of a variety of techniques. These project management techniques can be classified under two broad categories i.e. Bar Charts and Networks.

Bar Charts

Henry L. Gantt developed bar chart, better known as Gantt Chart for monitoring project activities. The chart is a pictorial representation specifying the start and finish time for various tasks to be performed in a project on a horizontal time-scale. Each project is broken down to physically identifiable and controllable units called the Tasks. These tasks are indicated by means of a bar, preferably at equi-distance in the vertical axis and time is plotted in the horizontal axis (Figure15.1). Length of the bar indicates required time for the task whereas the width has no significance. Though the bar chart is comprehensive, and very effective, it has the following limitations

Like many other graphical techniques are often difficult to handle.

Does not indicate the inter relationship between the tasks.



Time in months

Fig. 11 : Bar chart

Milestone Chart ·

Milestone chart is an improvement over the bar chart by introducing the concept of milestone. The milestone, represented by a circle over a task in the bar chart indicates completion of specific phases (activities) and after accomplishment of each of the specific activity a milestone is reached or in other words an even occurs. The chart also shows the sequential relationship among the milestones or events within the same task but not the relationship among milestones contained in different task. For example in figure15.2, the milestone 2 of task A cannot be reached until the milestone 1 is crossed and the activity between milestone 1 and 2 is over. Similarly, in task B the milestone 4 can begin only after completion of milestone 3. But the relationship between the milestone of task A and task B is not indicated in the milestone chart. Other weaknesses of this chart are as follows

- Does not show interdependence between tasks
- Does not indicate critical activities
- Does not consider the concept of uncertainty in accomplishing the task
- Very cumbersome to draw the chart for large projects.

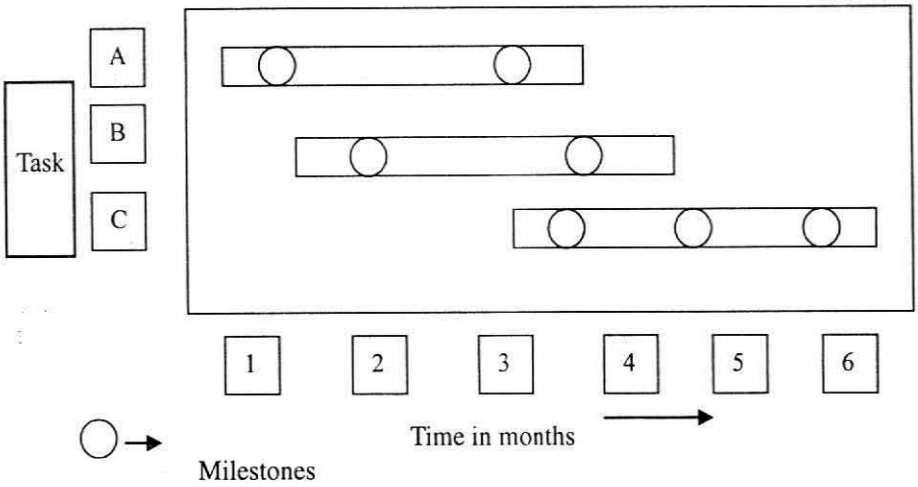


Fig. 12 : Milestone chart

Networks

The network is a logical extension of Gantt's milestone chart incorporating the modifications so as to illustrate interrelationship between and among all the milestones in an entire project. The two best known techniques for network analysis are Programme Evaluation and Review Technique (**PERT**) and Critical Path Method (**CPM**). These two techniques were developed almost simultaneously during 1956-1958. PERT was developed for US navy for scheduling the research and development activities for Polaris missiles programme. CPM was developed by FI du Pont de Nemours and Company as an application to construction project. Though these two methods were developed.

Simultaneously they have striking similarity and the significant difference is that the time estimates for activities is assumed deterministic in CPM and probabilistic in PERT. There is also little distinction in terms of application of these concepts. PERT is used where emphasis is on scheduling and monitoring the project and CPM is used where emphasis is on optimizing resource allocation However, now days the two techniques are used synonymously in network analysis and the differences are considered to be historical.

Programme evaluation and review technique (PERT)

The PERT technique is a method of minimizing trouble spots, programme bottlenecks, delays and interruptions by determining critical activities before they occur so that various activities in the project can be coordinated. Some of the terms frequently used in PERT are as follows.

Activity A recognizable work item of a project requiring time and resource for its completion.

Dummy activity Activity that indicates precedence relationship and requires no time resource.

Critical activity Activities on the critical path having zero slack/float time

Critical Path The longest time path connecting the critical activities in the project network. The total time on this path is the shortest duration of the project.

Event An instantaneous point in time signifying completion or beginning of an activity.

Burst Event An event which gives rise to more than one activity.

Merge event The event, which occurs only when more than one activity is accomplished.

Expected Time The weighted average of the estimated optimistic, most likely and pessimistic time duration of a project activity.

$$\textbf{Expected time (TE)} = \frac{T_o + 4T_M + T_P}{6}$$

Where, T_o is the optimistic time

T_M is the most likely time

T_P is the pessimistic time

Earliest Occurrence Time (EOT) The earliest possible time at which the event can occur. The EOT also denotes the earliest start time (**EST**) of an activity as activities emanate from events. The EST of an activity is the time before which it can not commence without affecting the immediate preceding activity.

Latest Occurrence Time (LOT) The latest time at which the event can take place. Also referred as the latest start time (**LST**) indicating the latest time at which an activity can begin without delaying the project completion time.

Slack The amount of spare time available between completion of an activity and beginning of next activity.

Steps for network analysis

The computation of slacks or floats, project probability, resource smoothening, and time-cost tradeoff are beyond the scope of present discussion. Hence the network analysis will be restricted to the following six steps.

1. Prepare the list of activities
2. Define the preceding and succeeding relationship for all activities.
3. Estimate the activity duration
4. Assemble the activities in the form of a flow diagram
5. Draw the network
6. Analyze the network i.e. compute EOT and LOT identify critical events, critical path and critical activities.

Activity slack bar chart (ASBC)

The activities in biological projects related to plants and livestock production systems are season bounded, time specific, and growth-pattern dependant. Therefore, these production systems consist of sequential activities having in built slack (waiting time). This slack is fixed and inflexible.

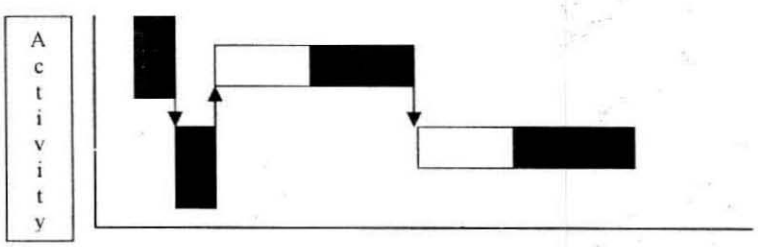


Fig. 13:

This means if an activity is having in built slack the real activity cannot start until the specified slack period is over. To reflect this particular dimension conventional bar charts are modified to Activity Slack Bar Charts (**ASBC**). In ASBC the bar is divided into two parts one with darkened area representing the actual activity period and other part for in built slack time in the activity (Figure15.3). The relationships between the activities are indicated by arrows (®) with the head and tail of arrow indicating the succeeding and preceding activity respectively. The arrows are drawn upward or down ward direction to align each activity separately.

Limitations

- Effective only for short duration projects
- Not helpful when activities involved in a project are many and concurrent in nature.

Network Analysis An illustration

Project Establishing a feed mill at CIFE

Step 1 Prepare the list of activity and give codes

The total project is subdivided into activities and each activity is given an alphabetical symbol/code. When the numbers of activities are more than 26, alphanumeric or multi–alphabet codes can be used

Table: 27 List of activities

Sr. No.	Activity	Symbol
1	Market survey	A
2	Procurement of machines	B
3	Installation of machines	C
4	Selection of m/c operator	D
5	Training of m/c operator with manufacturer	E
6	Test run	F

Step 2 Define the preceding activities

The inter dependencies and precedence relationships among he activities of the project are specified by identifying preceding activity. All other activities must appear atleast once as a preceding activity in the table.

Table: 28 Defining the preceding activities

Sr. No.	Activity	Symbol	Preceding
1	Market survey	A	-
2	Procurement of machines	B	A
3	Installation of machines	C	B
4	Selection of m/c operator	D	A
5	Training of m/c operator with manufacturer	E	B, D
6	Test run	F	C, E

Step 3 Estimation of activity time

The activity time is the time, which is actually expected to be expended in carrying out the activity. In determinist ic cases as in CPM one time estimate is used. In probabilistic cases as in PERT, the activity time has some kind of probabilistic distribution and is the weighted average of

three time estimates (Optimistic time, Pessimistic time and most likely time) for each activity. The expected time and its variance for each activity are computed as following.

$$\textbf{Expected Time } (T_1) = \frac{T_o + 4\,T_M + T_p}{6}$$

Where T_o is the Optimistic time (minimum time assuming everything goes well)

T_M is the Most likely time (modal time required under normal circumstances)

T_p is the Pessimistic time (maximum time assuming everything goes wrong)

Table 29: Estimation of activity time

Sr. No.	Activity	Symbol	Predicting activity	Optimistic time T_o	Most likely time T_M	Pessimistic time T_p	Estimated time T_E
1	Market survey	A	—	1	2	3	2
2	Procurement of m/e	B	A	2	3	4	3
3	Installation of machine	C	B	4	2	3	2
4	Selection of operator	D	A	2	3	10	4
5	Training of machine operator	E	D, B	3	4	11	5
6	Test run	E	CE	4	2	3	2

Step 4 Assemble the activities in the form of a flow chart

In a flow chart the activity and its duration is shown in a box. The boxes are connected with the lines according to the preceding activity relationship. The critical path for the project can be identified comparing the various path lengths (sum of activity time on the path). The longest path in the chart is the critical path. The flow chart does not give many details lime start and completion time of each activity.

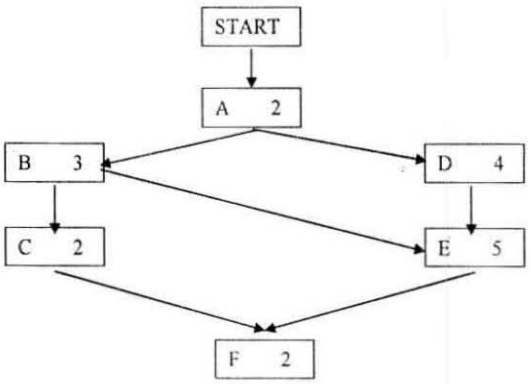


Fig. 14 : Flow chart of activities

Path 1 A-B-E-F 2+3+5+2 = 12

Path 2 A-B-C-F 2+3+2+2 = 9

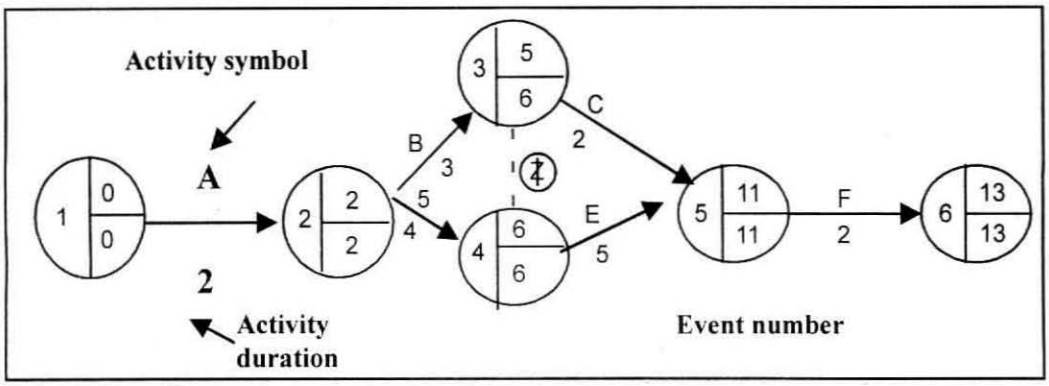
Path 3 A-D-E-F 2+4+5+2 = 13

Critical path is A-D-E-F (longest path)

Step 5 Draw the network

Rules for drawing the network

1. Each activity is represented by one and only one arrow in the network
2. Dotted line arrows represent dummy activities
3. A circle represents an event
4. Every activity starts and ends with an event
5. The same head and tail event can identify no two activities
6. Do not use dummy activity unless required to reflect the logic
7. Avoid looping and crossing of activity arrows
8. Every activity, except the first and last, must have at least one preceding and one succeeding activity.
9. Danglers, isolated activities must be avoided
10. For coding use alphabets for all activities including the dummy activity and numbers for events



(4) Dummy activity **Fig. 15 : Network diagram**

Step 6 Analyze the network i.e. computes EOT and LOT, identify critical events, critical path and critical activities.

Computing earliest occurrence time (EOT) and latest occurrence time (LOT)

The EOT and LOT are computed in two phases. The EOT is calculated first in the forward pass beginning from the start event. For the start event the EOT is always set to zero so that it can be sealed to any convenient calendar date at a later stage. The EOT at the last event is generally considered to be the project duration i.e. the minimum time required for project completion. Therefore, EOT and LOT are equal at the end event. LOT for other events is then calculated through backward pass starting from the end event. Steps involved in computation are listed below.

EOT	LOT
Through forward pass	Through backward pass
Calculation begins from start event	Calculation starts from end event
Proceeds from left to right	Proceeds from right to left
At start event EOT is zero	At end event LOT equals to EOT
Adding the activity time to EOT	Subtracting the activity time from LOT
At a merge event take maximum value	At a burst event take minimum value

Table 30: Computation of EOT and LOT for the project is as follows

Event No.	EOT	Event No.	LOT
1	0	6	13
2	0+2= 2	5	13-2=11
3	2+3=5	4	11-5=6
4	Max (2+4=6, 5+0=5)=6	3	Min (6-0=6, 11-2=9) = 6
5	Max(5+6=11, 5+2=7)=11	2	Min (6-3=3, 4-2=2) = 2 6
11+2=13	1	2-2 = 0	

Identification of critical events

The difference between LOT and EOT for an event is called event stack. For critical events this stack is zero i.e. the value of LOT and EOT are equal. The event stack computed for all the events of the project are as follows

Table: 31 Identification critical event

Event No	LOT	EOT	Event slack	Critical/NC
1	0	0	0	Critical
2	2	2	0	Critical
3	6	5	1	Not critical
4	6	6	0	Critical
5	11	11	0	Critical
6	13	13	0	Critical

With above values of EOT, LOT and event slack the critical events are 1, 2, 4, 5, and 6.

Identification of critical activity

An activity can be called as critical activity if the following conditions are satisfied.

1. LOT and EOT are equal at the head event

   ii . LOT and EOT are equal at the tail event
2. Difference between EOT at head and tail event of the activity equals to the activity time
3. Difference between LOT at head and tail event of the activity equals to the activity time

Review of computation results suggests that the critical activities in the project are A, D, E and F.

Identification of critical path

The critical path is the chain of critical activity spanning the network from start to end of the project network. Alternatively therefore comparing all the possible path lengths can identify the critical path (see flow diagram) the critical path time is the shortest duration of the project. The critical path is denoted preferably by denoting the critical events on the path.

Critical path for the projects A D E F

The critical path of the project can also be denoted in terms of the event numbers. In the present project it is 1-4, 5, 6. To distinguish the critical path from other paths in the project it is preferable to use a thicker line to demarcate the critical path. It is quite possible that a project can have multiple critical paths. In such case length of all the critical paths will be equal.

CHAPTER 16

INVENTORY MANAGEMENT AND CONTROL

Inventory Management :-

Introduction

Inventories constitute the most significant part of current asset of a large majority of companies in India. On an average inventories are approximately 60 percent of current asset in public limited companies in India. Because of the large size of inventories maintained by firms, a considerable amount of funds is required to be committed to them. It is absolutely imperative to manage inventories efficiently and effectively in order to avoid unnecessary investment.

Inventory

The dictionary meaning of the word inventory is "stock of goods". Classical definition of inventory is that "it is an idle resource of any kind having an economic value.

Inventory Mangement

Includes the procedure and the body of knowledge, which can help us in planning to maintain an optimum level of the idle resource?

Nature of inventories

Inventories are stock of product a company is manufacturing for sale and component that make up the products.

The various forms in which inventories exists in a company are

Raw materials:- Are those basic inputs that are converted into finished product through the manufactuing process. Raw material inventories are those, which have been purchased and stored for future production.

Work in progress:- Inventories are semi-manufactured products. They represent products that need more work before they become finished products for sale.

Finished goods:- Inventories are those, which are ready for sale. Stock of raw materials and work in process facilitate production, while stock of finished goods is required for smooth marketing operation.

Thus inventories serve as a link between production and consumption of goods. The level of three kinds of inventories for a firm depends on the nature of its business. A manufacturing firm will have substantially high levels of all three kinds of inventories while retail or wholesale firm will have a very high level of finished goods inventories. The level of inventory also depends on the production cycle. The firms that produce long production cycle products carry large inventories, while inventories of consumer product company will not be large because of short production cycle and fast turn over.

Need to hold inventories:

For smooth production and to meet adequate market demands holding of inventories are essential. There are general motives for holding inventories.

1. Transaction Motive: Emphasis the need to maintain inventories to facilitate smooth production and sales organisation.

2. Precautionary Motive: Necessities holding of inventories to guard against the rise of unpredictable changes in demand and supply forces and other factors.

3. Speculative Motive: Influences the decision to increase or reduce inventory levels take advantage of price fluctuation.

Role of Inventory Management

A company should maintain adequate stock of materials for a continuous supply to a factory for an uninterrupted production. It is not possible for a company to procure raw material whenever it is needed. A time lag exists between demand for materials and supply. Also there exists uncertainty in procuring raw materials in time on many occasion. Work in progress inventory builds up because of production cycle. Production cycle is the time span between introduction of raw material into production and emergence of finished products at the completion of production cycle. Stock of finished goods has to be held because production and sales are not instantaneous. Therefore to supply finished goods on a regular basis has to be maintained.

The inventory mangement plays a vital role in balancing these factors. The inventory management maintains coordination between the different steps and facilitates the smooth running and helps in profit maximization of a firm by cutting or reducing the investment on its inventories. Thus inventory management is the balancing of a set of costs that increases with larger inventory holdings with a set of costs that decreases with larger order size.

Inventory policy is determined by the economics of the firm's industry, the inventory policies of a firm in a give industry can vary widely-inventory policies is very much subject to discretionary decision. A firm's inventory policies is set by its executive committee, since production, marketing and financial people all have a stake in inventory management. The production manager is concerned with raw material inventories to ensure continuous production, he/she has a direct control over length of the production process, which influences work in process inventories and is vitally concerned with whether the firm produces goods in a smooth, continuous basis throughout the year, stockpiling finished goods inventories for seasonal sales or produce regularly in response to order.

The marketing manager wants the firm to hold large stocks of inventories to ensure rapid deliveries. The financial manager is concerned with the level of inventories because of the effects of excessive inventories on profitability:

1. Inventories reduces the total assets utilization ratio:

$$\text{Total asset utilization (Turnover)} = \frac{\text{Sales}}{\text{Total assets}}$$

2. There are substantial costs of carrying inventories so excessive inventory erodes the profit margin.

Objective of inventory management

1. To maintain a large size of inventory for efficient and smooth production and sales operations.
2. To maintain a minimum investment in inventories to maximize profitability.

Both **'excessive'** and **'inadequate'** inventories are not desirable. The objective of inventory management should be to determine and maintain optimum level of inventory investment. A firm should always avoid a situation of over investment or under investment in inventories.

The major dangers of over investments are :-

a) Unnecessary tie-up of the firm's funds and loss of profitability.
b) Execessive carrying costs.
c) Risk of liquidity.

Maintaining an inadequate level of inventories may cause

a) Production hold-up

b) Failure to meet delivery commitments.

The aim of inventory management, thus should be to avoid excessive or inadequate levels of inventories and to maintain sufficient inventory for the smooth production and sales operation. Efforts should be made to place an order at the right time with the right source to acquire the right quantity at the right price and quality.

An effective-inventory management should

(i) Ensure continuous supply of raw materials to facilitate uninterrupted production.

(ii) Maintain sufficient stocks of raw material in periods of short supply and anticipated price changes.

(iii) Maintain sufficient finished goods inventory for smooth sales operation and efficient customer service.

(iv) Minimize the carrying cost and time and

(v) Control investment in inventories and keep it at an optimum level.

Inventory management technique :

Inventories are obvioulsy necessary but it is equally obvious that a firm will suffer if it has too much or too little inventory. Efficiently controlled inventories make the firms flexible. Insufficient inventory control results in unbalanced inventory and inflexibility. To manage inventories efficiently answer should be sought to the following two questions :-

1) **How much should be ordered? - By EOQ**

2) **When it should be ordered ? - By Re-order point**

One commonly used approach to determine the optimal level of inventory is the **'Economic ordering quantity'** or **'EOQ'.**

Economic Ordering Quantity (EOQ) : It is the optimum (least count) quantity of inventory that should be ordered. Inventory of any item consists of a working stock and a safely stock.

Working stock - depends on the pattern of inflow and outflow.

Safety stock - designed to guard against unexpectedly high demands, delay in receiving shipments or both.

Determining an optimum inventory level involves two types of costs :

a) Ordering costs : This is the cost associated with getting an item into the firm's inventories. The term ordering costs is used in case of raw materials (or supplies) and includes the entire costs of requiring raw materials.

E.g. purchase ordering, transportation charges, order placing, salaries, storage cost, etc.

Ordering costs increase with the number of orders, thus the more frequently the inventory is required, higher the firm's ordering costs. On the other hand, if the firm maintains large inventory level, there will be few orders placed and ordering costs will be relatively small. The ordering costs decreases with increasing size of inventory.

b) Carrying / holding costs : Costs incurred for maintaining a given level of inventories are called carrying costs.

E.g. Storage, insurance, taxes depreciation etc.

Table 32: Ordering and carrying costs :

Ordering cost	Carrying cost
- Requisitioning	- Warehousing
- Order placing	- Handling
- Transportation	- Insurance
- Receiving, inspecting and storing	- Depreciation
- Clerical and staff	- taxes

Determination of EOQ :-

Suppose a firm has -

Estimated annual requirement : A = 1200 units
Purchasing cost/unit, P (Rs.) = 50 Rs.
Ordering cost/order (Rs.) 0 = 37.50 Rs.
Carrying cost per unit = 1 Rs.

Table 33 : A Company has order for raw material in different lots as shown in the following table

No. of orders	Order size (Q)	Avg. inventory cost I	Annual carrying cost (O)	Annual ordering	Total cost
1	1200	600	600	37.5	637.5
2	600	300	300	75	375
3	400	200	200	112.5	312.5
4	**300**	**150**	**150**	**150**	**300**
5	240	120	120	187.5	307.5
6	200	100	100	225	325
8	150	75	75	300	375
10	120	60	60	375	435
12	100	50	50	450	500

Average inventory cost – it is assumed that avg. inventory is equal to the half of the maximum inventory (order size)

$$\textbf{Average inventory} = \frac{\text{order size}}{2} = \frac{Q}{2}$$

Carrying cost – usually expressed on an annual basis as a %of avg. inventory.

Total carrying cost = avg. inventory X per unit carrying cost

Total inventory cost = total carrying cost + total ordering cost.

The objective of determining the EOQ is to minimize the sum of ordering cost and carrying cost

Formula for EOQ –

$$\textbf{EOQ} = \sqrt{2 \text{ X AO/ C}}$$

Here,

EOQ = economic ordering quantity, or optimal quantity to be ordered each time an order is placed

A = order size

O = ordering cost C = carrying cost /unit

In the above example EOQ will be minimum at an order size of 300 and no of order should be in 4 lots.

By using formula –

$$EOQ = \sqrt{2 X AO / C}$$

$$EOQ = \sqrt{2 X 1200 X 37.5 / 1} = 300 \text{ units}$$

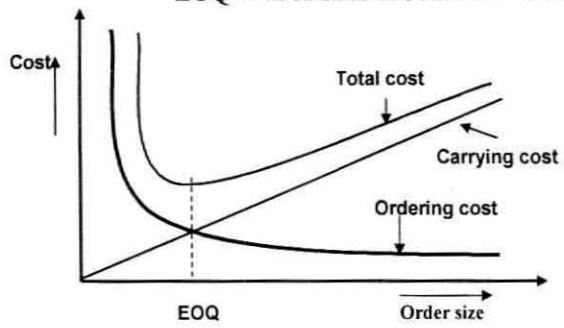


Fig. 16 : Economic Ordering Quantity

Explanation : Carrying cost rises steadily as order size increases; ordering cost on the other hand decline with larger order size. The sum of these two curves and the lowest point on that curve is the optimal order size or EOQ.

Assumption of EOQ

1) Sales can be forecasted perfectly.

2) Sales are evenly distributed throughout the year

3) Orders are received without any delay.

Re-order Point

When to order? This problem is the determining of the re-order point. Re-order point is that inventory level at which an order should be placed to replenish the inventory. To determine re-order point under certainty we should know-

1) Lead-time 2)Average usage 3)EOQ

Lead-time – it is the time normally taken in replenishing inventory after the order has been placed.

Re-order point = Lead-time X average usages.

MANAGEMENT CONTROL

Management Control

The process through which managers assure that actual activities conform to planed activities there is a close link between planning and controlling the organzations operations.

The control process measures progress towards goals and of the organizations and enables managers to detect deviations from the plan so that they can take whatever remedial action is necessary.

What is control ?

Management control is a systematic effort to set performance standards with planning objectives, to design information feed back system, to compare actual performance with these predetermined standards to determine deviation and take any corrective action to assure that all corporate resources are being used in the most effective and efficient way possible in achieving corporate objectives.

Four basic steps of control

1. Establishing standards and methods for measuring performance
2. Measuring actual performance
3. Comparing performance against standards and interpreting any descrepancies
4. Taking corrective action

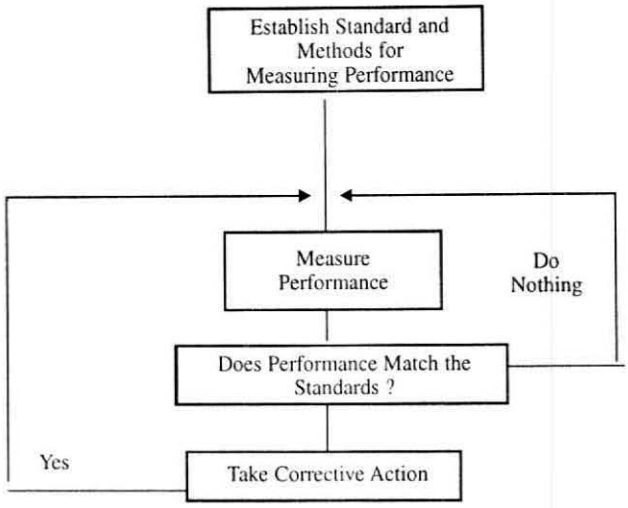


Fig. 17 : Basic steps in the control process

Step in the control process

1. **Establishing standards and methods for measuring performance :-**

This step could involve standards and measurements for everything from sales and production target to worker attendance to safety records. To make this step effective, the standards much be specified in meaningful terms and then must be accepted by the individuals involved.

2. Measuring actual performance :-

This is a ongoing process. The performance should be continuously monitored to find out any deviation to avoid long - term decline in the sales or production output.

3. Comparing performance against standards :-

It is simply a matter of comparing a measured result with the target or standards previously set. If performance matches standards, managers may assume that everything is under control. Then there is no need of any corrective action. But if the performance any mismatches the performance then it is needed to interpret any deviations from the standard.

4. To take corrective action :- (Final step)

If performance falls short of standards and analysis indicate action is required. This corrective action involves a change in one or more aspects of the organization's operation or it may involve a change in the standards originally established.

Need for control

Some of the most important factors which creates needs for control are –

1. Changing environment of the organization :- change is an integral part of almost any organization's environment. Market shifts, new product emerge, new materials are discovered, and new regulations are passed.

2. Complexity :- complexity refers to the changing market, sales in different outlets, quality of the finished goods. In view of this the organization's various markets, foreign and domestic, require close monitoring. Decentralization of an organization further adds complexity.

Degree of control :-

In a changing and complex organizational set-up need for control in organization is particularly acute today. But there should be a balance between organizational control and personal autonomy. Too many means of methods of control will harm the organization as well as the individual within it. To many control give negative results in terms of limit in behavior, killing of motivation, inhibit creativity and in the end damage organizational performance. On the other hand inadequate control will of course harm the organization by allowing resources to be wasted and making it more difficult for organizations to attain its goal.

Types of Control Methods

Most of the methods of control can be grouped into three basic types –

1. Steering or feed forward control
2. Yes-no or screening control
3. Post action control or feedback control

1. Steering control / Feed forward control :- Are designed to detect deviation from some standard or goals and to allow correction to be made before a particular sequence of action is completed. This can be done through careful and repeated forecast using the latest available information. Feed forward control is accomplished by analyzing the inputs so that adjustment can be made in them or in the process before outputs from the system occurs.

2. Yes-no or screening control :- This type of control provide a screening process in which specific aspects of a procedure must be approved or specific condition met before operation may continue. Most common example of yes-no control is quality control inspections safety checks and legal approval of controls.

3. Post-action control or feedback control :- As the term suggest post action control measures result from a completed action. The cause of any deviation from the plan or standard is determined, and corrective action is applied to future activities that are similar to those that have already been completed. Post action controls are also used as a basis for rewarding encouraging employees.

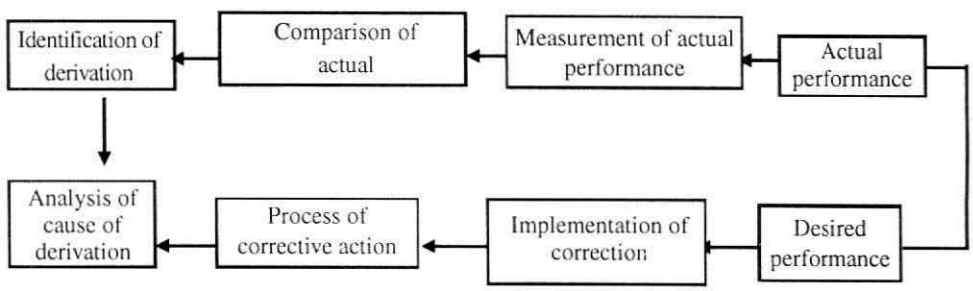


Fig: 18 Feedback loop of mangement control

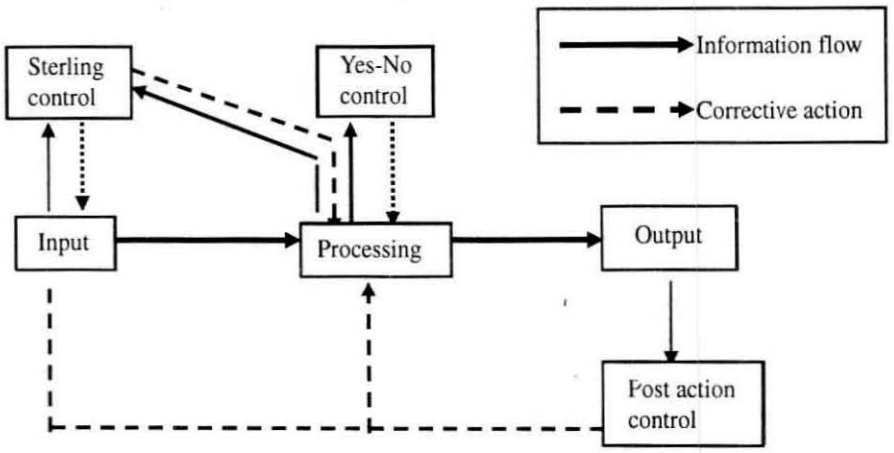


Fig: 19 Flow of information and corrective action for three types of control.

Characteristics of a effective control system :-

1. Accurate
2. Timely
3. Objective and comprehensible
4. Focused on strategic control point
5. Economically realistic
6. Organizationally realistic
7. Co-ordinated with the organization's workflow
8. Flexible
9. Prescriptive and operational
10. Acceptable to organizational member

CHAPTER 17

MANAGEMENT INFORMATION SYSTEM

Introduction

Modern technology has been able to make a major contribution towards improved management practice with respect to information system. The contribution is possible because of two factors; firstly, the generally increased sophistication of management theory and practice, permitting the identification of information needs and uses, and secondly development of electronic data processing permitting the analysis of huge quantity of data in a short enough time to permit use.

Information is the blood of an asuarinas. Information is the data transmitted before or after processing. Management is the planning, implementation and control of a set of resources to achieve objective. A system is sets of sub system having interdependence so as to form a complex unity.

Management Information System is thus a system in which required data are collected, analyzed and transmitted to help the managers at various levels in the process of planning, implementation and evaluation. It is a system, which provides management with the information it, requires to monitor progress, measure performance, detect trends, evaluate alternatives, and make decision and to take corrective action.

Information is the planners' raw material, forming the basis for the diagnosis, structuring his objectives and permitting him to evaluate the programme's efficiency and effectiveness. Information can be studied analyzed organized, stored for future reference, summarized and displayed.

Components of Management Information System

The term MIS is composed of three elements viz – Management, Information and System.

1. Management

Management is the process of getting things done through and with people. A manager in an organization gets the things done by performing the following 5 basic functions –

1. Planning
2. Organizing
3. Staffing
4. Directing
5. Controlling

Managers plan by setting goals and objectives and lay down policies, procedures, rules, programmes, budgets, strategies and schedule to achieve the plan. Managerial task is to divide activities, assign duties for effective operation and achievement of goals.

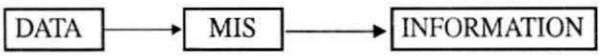
Staffing is putting right person at the right job. Directing is important because in order to get the predetermined goals and objectives, people manning the organization have to be guided, motivated and supervised by the managers.

Managers control the performance of the work by setting performance standard and avoiding deviation from standard.

To perform above functions, a manager has to take variety of decision. Thus decision making is a functional pre-requisite for each of the forgoing process.

2. Information

Information is data that is processed in a form, which helps the management to take decision. The relation between data and information is that of raw material to finished products.



3. System

A system is a set of elements joined together to achieve a common objective(s). A system is made up of sub system, which may be composed of further sub-system. E.g. Business organization is a system and the parts (division, departments, functions, units) are the sub-system.

Fig : 20 Business organization as a system

Definition of MIS

MIS is a system having a combination of persons, machines, procedures data base, as its elements, which gather data from intra and extra sources of an organization and after processing these data, supply management information to the managers in an organization support the decision making process of the management.

Need of MIS

MIS has become necessary for organization to meet the following emerging development.

- Increased complexity of the organization.
- Development of technological revolution.
- Emphasis on research and development.
- Diversification of function and activities.
- Information explosion.
- Complex management issue.
- Development of electronic computers.

Advantage of MIS

1. Timely availability of information develops a high degree of confidence between top executives and the members of the management.
2. Management has not to resort to frequent meetings to sort out different issues.
3. The executive time can be saved and devoted to critical issues.
4. It helps in reviewing actual performance and devise corrective action.
5. It helps in reviewing strength and weakness of an organization

Essentials of good information system

1. **Accuracy and timeliness –** the information collected must be accurate and available in time otherwise its use could be limited.
2. **Quantitive adequacy-** information collected should be adequate to suit the needs of the organization the collection of more information than required would cost more and thus increases unnecessary expenditure
3. **Designing of tools according to the need –**A good information system should be according to needs of the organization.
4. **Cyclical flow** – the information must flow constantly otherwise its use would be limited.
5. **Economic value –** The economic value of information is measured by the gain achieved from using such information.
6. **Recipient point of view –** information conveyed to a receiver should infuse the desired knowledge in him. The receiver in terms of its use to him must measure the value of information.
7. **Managerial view –**

a) It must be informative in the sense of decreasing the amount of uncertainty.

b) It must demand action.

c) It must motivate an appropriate action. Unsatisfactory result should be prevented by its use.

Aspects of MIS

MIS has the following elements -

- Inputs
- Analysis and processing
- Storage and retrieval
- Output
- Flow

Both input and output are directly related to information requirements of organizations. The information include both the inflow of the input as well as outflow of the information

Steps for design and installation of MIS

1. Analysis and determination of system's requirements
2. Design of MIS
3. Procurement of necessary material
4. Installation
5. Operation and follow up

All these five steps are interrelated

1. Analysis of system's requirements :- It analysis in depth the system's requirements. Such an analysis will require answer to question like –

- What are the objectives of the organization ?
- What are the activities to be carried out ?
- What type of evaluation is required to assess the impact of its activities ?
- Who will collect the data ?
- How will the data be collected ?
- Where, how and by whom will the data processed ?

- How accurate and reliable should such data be ?
- What will be the frequency and timeliness of the report ?
- Who will use the information generated and how it will be used ?

2. Design of information system :- The next step is the actual design of an information system covering all its 5 elements mentioned earlier, in such a manner that it fulfills with minimum cost and in the required form. The following points may be kept it mind.

(a) The generated at various levels should correspond to that actually needed for management at that level.

(b) The necessary link between the various sub-system of the MIS should be provided.

(c) An appropriate method for the processing and analysis of basic data should be designed.

3. Procurement of necessary material :- The third steps is the production of necessary material and the provision of required facilities so that the system could be put into operation, e.g.; for a manually operated system the formats have to produce.

4. Installation :- The information system should be set up keeping in mind to retain as far as possible the existing procedure and system.

5. Operation and follow up :- The out put of system is examined against the objectives for which the system was designed. It should be the endeavor to continuously improve upon the system taking into account the changed situation.

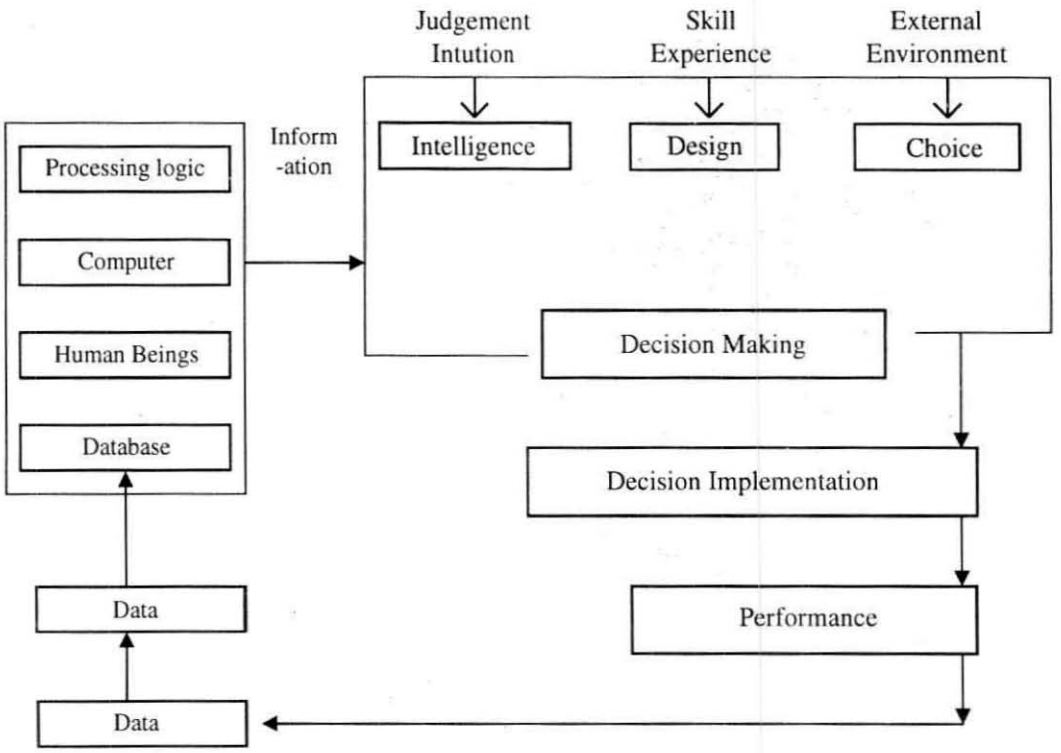


Fig 23 : The Concept of Management in Information System

Part - VII

Institutions and Interventions in Fisheries Projects

CHAPTER 18

ROLE OF FINANCIAL INSTITUTIONS IN FISHERIES

Introduction

Fisheries is assuming great importance in agricultural economy of developing countries including India. In India, fisheries sector has reached commercial level from traditional artisanal level. Our export earnings through fish and fish like items have been on increase for the last two decades. This has necessitated heavy financial investments and bankers were asked to support this major area. From the time fisheries was declared as allied agricultural activity and brought under priority sector, responsibility of financial institutions to support fisheries development activity has further increased.

India's fish production during 1999-2000 is 5.65 million tons contributed by Marine and Inland sector at the ratio of 5050. India ranks 3rd in over all fish production and 2nd in Inland fish production among fish producing countries. Marine export contributed about Rs.6443 crores to national economy in 2000, which is 23% more than last year contribution. The fisheries sector contributes about 1.28% to the total GDP and 4.12% to the GDP from Agriculture sector. The fisheries sector has grown at a pace of 6% p.a. during the 8th five-year plan. India has an estimated fish production potential of 8.4 mill tons (3.9 mill tons from marine and 4.5 mill tons from Inland sector). This potential is from the following resources. Indian coastal length 8124 kms, EEZ area is 2.01 mill. Sq.kms. Rivers and canals of 171334 km, reservoirs of 2.05 mill.ha, tanks and ponds of 2.855 mill.ha, oxbow lakes and derelict water of 0.788 mill.ha, and the brackish water resources around 1.42 mill.ha. Fisheries sector is being given emphasis as far as food security of the nation is concerned. In this development aspect comes the financial institutions, which contributed, contributes, will contribute enormously for the growth of this sector.

Broad classification of source of finance

Financial source (either grants or loans) can be classified by the following heads;

1. Multilateral Agencies,
2. Bilateral Agencies,
3. National Governments,
4. Non-Governmental Organisations,
5. Private sectors including Community and Household resources.

Generally speaking support from both Multilateral and Bilateral agencies for agricultural and allied activities has been declining and at the same time support to NGOs is in increasing trend.

Multilateral grants and loans

The two most common sources of credit for Asia's developing countries are

a. The World Bank

b. The Asian Development Bank.

a. The World Bank

World bank loans to Asia's agricultural sector are $ 231.8 mill. In 2001.

Asian Development Bank

In 1997 ADB approved 632 loans, of which 10% went to agriculture and allied sectors.

Other multilateral agencies

a. United Nations Development Project, (UNDP)
b. United Nations Development Fund for Women, (UNIFEM)
c. United Nations International Children's Emergency Fund, (UNICEF)
d. United Nations Development Cooperation Project
e. Food and Agricultural Organization (FAO)
   Schemes;
   TCDC,
- Special Food Security Programs,
- Technical co-operation Programs.

Bilateral Programmes

Bilateral institutions have in past worked with Government organizations. But as with multilateral the direction has changed toward assistance to NGOs and private sector.

Bilateral Agencies provide funds for rural development including fisheries. They are

1. US Agency for International Development (USAID),
2. Australian Agency for International Development (AusAID),
3. Canadian International Development Agency (CIDA),
4. Danish International Development Agency (DANIDA),
5. Norwagien Agency for Development (NORAD),
6. GTZ (Germany),
7. GRET (Greece),
8. Belgium and Netherlands also has bilateral programs,
9. European Union Development Fund.

National Programs

1. Government Financial Institution Credit Programs for Various Sectors of Rural Development. Many of these programs are unsuccessful due to

* Complicated loaning procedures,
* High transaction costs
* Unrealistic repayment schedules,
* Poor loan recovery
* Dole-out mentality among farmers
* Mismanagement

2. Micro financing for poor, eg. NABARD. Here the problems or constraints are

- Many programs do not target the poorest of the poor and so the beneficiaries are non-poor.
- Poors don't have collateral security.

Non Governmental Organization

As Non-Governmental Organizations work at the village level they become the Vehicle for donor agencies program implementation. They follow micro finance through Group-based Rural Finance Projects (GFPs) and Community based Resource Management Program. Some of the NGOs working in fisheries are Ramakrishna Mission, Lutheran World Service, Don bosco Society, Nehru Yuva Kendra, Kamala Nehru Trust, Tagore Rural Development Society. The important or popular project getting momentum is the SHG that is Self Help Group.

Private sector

They offer assistance through commercial banks and financial institutions, they are **Informal banking system** such as Credit Unions, Pawnshops, Saving and Credit associations, Landlords, Moneylenders and Traders who lend money or in kind loans.

Disadvantage in this system is higher interest rate.

Community or Groups It is becoming popular. These are community based farmer groups, village associations and cooperatives, which are sources of funds for development. Much of the fund is generated through group savings.

Household level It includes resources in the form of labour.

As far as Indian Marine fisheries sector is concerned the access of finance goes in this order,

1. Fish merchants (Middleman),
2. Professonal moneylenders,
3. Money from relatives, chit funds or local savings,
4. Cooperative banks,
5. State finance corporations,
6. Branches of commercial banks and regional rural banks.

Reserve Bank of India

History

India's Central Bank, the RBI was established on 1st April 1935 through Reserve Bank of India Act, 1934. RBI was nationalized on 1st January 1947. The Central office is at Mumbai. It has 22 regional offices; most of them are in state capitals.

The hierarchy in RBI is as follows

Central board of directors
|
Governor
|
Deputy Governors
|
Executive Governors
|
Principal Chief General Manager
|
Chief General Manager in charge
|
General Managers
|
Deputy General Managers
|
Assistant General Manager
|
Manager
|
Assistant Manager
|
Supporting staffs

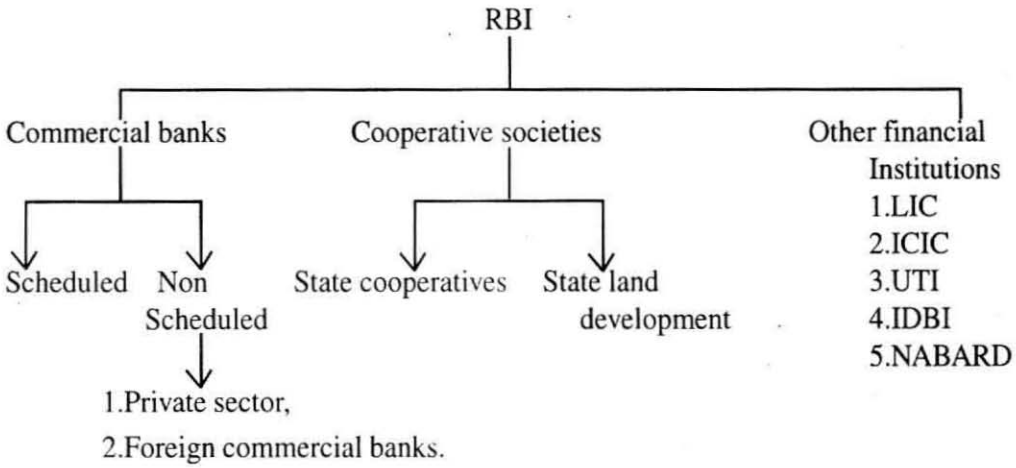


Fig. 22 : Financial System Under RBI

Functions

* Regulating issue of bank currency notes,
* Managing India's foreign exchange reserves,
* Operating India's currency and credit system with a view to secure monetary stability,
* Developing India's financial structure in line with socioeconomic objectives and policies,
* As bankers to the Governments, commercial banks, state cooperative banks, and some financial institutions,
* Important role in maintaining exchange value of rupee,
* Agent of government in International Monetary Fund,
* Developmental and financial functions.

Specific functions of RBIs departments

There are various departments under RBI. The departs dealing with finance are as follows;

Urban Banks Department

They supervise primary cooperative banks, and also do regulatory, supervisory, operational and developmental works.

Rural planning and credit departments

They do following functions;

Monitor and facilitate flow of credit to rural agricultural and small industries sectors, Framing policies on priority sector lending, Support to NABRAD, Making allocations for contribution to rural infrastructure development fund (RIDF) amongst scheduled commercial banks, Implementing and monitoring lead bank scheme which aims at forging a coordinated approach for providing bank credit to achieve overall rural development, Setting up of local area bank, Regulator of regional rural bank, state/central cooperative banks and local area banks, Monitoring poverty alleviation schemes, Implementation of banking ombudsman.

World bank

History

World Bank group consist of World Bank, International Finance Corporation (IFC),

Multilateral Guarantee agency (MIGA) and International Center for Settlement of Investment Disputes (ICSID).

World Bank

The International bank for reconstruction and development (IBRD) and International development association (IDA) are collectively called as World Bank.

IBRD

It was established in 1945, oldest and largest body Among World Bank group. 183 countries subscribed its capital. Only IMF member can become member. Subscription depends on each one's quota in IMF.

Salient feature

- Loans only to credit worthy borrowers,
- To those projects promise high real rates of economic return,
- No reschedule of payments,
- No loss,
- Cumulative lending upto year 2001 $360 bill, in 2001 it is $ 10.5 bill. (south asia's share 18%, If you see urban, its share 2%, for agriculture and environment the share is 12%.

IDP

It was established in 1960. Membership open to all members of IBRD. Total no of member countries are 162.

Salient features

- Assistance to only poorer (Annual per capita GDP<$696) developing countries (60 countries eligible)
- Credits to government only,
- Period 35-40 years,
- No interest (only 0.5% of loan as service charge),
- Cumulative lending upto year 2001 $127 bill, in 2001 it is $ 6.8 bill. (South Asia's share 18%, If you see urban, its share 2%, for agriculture and environment the share is 12%.

IFC

It was established in 1956. The total no of members are 175 countries.

Salient features

- Work closely with private investors from around the world and invests in commercial enterprises in developing country,
- Provides loans and makes equity investments.

MIGA

It was established in 1988. The total no of members are 154 countries.

Salient features

- Promotion of investment for economic development in member countries through guarantees to foreign investors against losses caused by non-commercial risks through advisory and consultative services.
- Assist developing countries in creating responsive investment climate and information base to guide and encourage the flow capital.

ICSID

The total no of member countries 134.The total no of cases registered in 2001 is 12.

Purpose of World Bank

To promote economic and social progress in developing nations by helping raise productivity so that there people may live better and fuller life.

Areas of assistance

1. Adjustment related (including rural development) sector,
2. Agriaultural/rural development sector,
3. Education,
4. Environment,
5. Industry/Energy,
6. Infrastructure/Urban development,
7. Population, health and nutrition,
8. Rehablitation/reconstruction.

Financial Allotment Data for 2001.

Loan disbursement $ 17.3 bill.,
(IBRD-10.5 +6.8 billion.)

Loan outstanding

IBRD — $ 120104.11 mill.
IDA — $ 8664.38 mill.

Some of the World Bank assisted fisheries schemes

1. Gujarat fisheries project ($ 38 million)

   Development of harbor at Mangalore and Veraval (Infrastrutural facilities, purchase of mechanized fishing boats and dug-out canoes)

2. Andhra Pradesh fisheries project ($ 35 million)
   Infrastructure at Kakinada, Vizag, Nizamapatnam and supply of mechanized fishing vessels and sail crafts.

3. Inland fisheries project in five inland states ($ 9.3 million)

   Fish pond development involving 117000 ha water area and construction of 27 modern fish seed hatcheries were to be developed and 14 have come up.

4. Resevoir fisheries development project.

5. IDA assisted brackish water inland fisheries project in the states of Andrapradesh, Bihar, Orissa, Utterpradesh, and West Bengal.

National Bank for Agricultural and Rural Development (NABARD)

History

Reserve bank of India was established in 1935 with a mandate to set up agricultural credit department with expert staff. Then came Agricultural Refinance Corporation (ARC) in 1963. It was renamed as Agricultural Refinance and Development Corporation (ARDC) in 1972. Then a committee called CRAFLCARD formed in 1979 and reviewed the credit structure and recommended formation of NABARD. Then NABARD Act was passed on 12/6/1982 and NABARD was established with initial capital of Rs 100 crores.

NABARD's head quarter is at Mumbai. It has 25 regional office and one sub office. It also has 4 training establishments.

Functions

NABARD is an apex institution accredited with all matters concerning policy, planning and operations in the field of credit for agricultural and other economic activities in rural areas.

It is an apex refinancing agency for the institutions providing investment and production credit for promoting the various developmental activities in rural areas.

It takes measures towards institution building for improving absorptive capacity to the credit delivery system, including monitoring, formulation of rehabilitation schemes, restricting of credit institutions, training of personnel etc.

It coordinates the rural financing activities of all the institutions engaged in developmental work at the field level and maintain liaison with government of India, state government, RBI and other national level institutions concerned with policy formulation.

It provides an annual basis rural credit plans for all rural financial institutions.

It undertakes monitoring and evaluation of projects refinanced by it.

It promotes research in the field of rural banking and rural development.

They refinance to;

State Land Development Banks (SLDB),
State Coqperative Banks (SCB),
Regional Rural Banks (RRB),
Commercial Banks (CB),
Other RBI approved financial institutions.

Depending on the type of proposed project and area of operation, NABRAD refinance ranging between 75% and 95% of the total bank loan. In fisheries sector it caters to the long-term and medium term credit requirements.

Interest rate

Earlier interest is at the rate of 6.5% to 8% for banks. Other beneficiaries have to pay a rate of 10-12.5% rate. That is small farmers 10% and others 12.5%

Now, For beneficiaries,

Up to Rs 7500	--	11.5%
Rs 7500 – 25000	--	13.5%
Rs 25000 – 0.2 mill	--	15%
Rs 0.2 mill & above	--	16.5%
100% export oriented loan	--	15%

For banks 4% less in each category

Margin money

Small and medium farmers	—	5-15% of total outlay,
Large and corporate bodies	—	5%
Deep sea	—	25%.

Beneficiaries

Individuals, Group of progressive entrepreneur, fishermen cooperative societies, fishermen federations, state fisheries development corporations and also private companies.

Other agencies provide credit to fisheries sector through NABARD refinance are as follows;

1. Industrial Finance Corporation of India (IFCI),
2. Industrial Development Bank of India (IDBI),
3. Shipping Credit and Investment Company of India (SCICI),
4. Industrial Credit and Investment Corporation of India (ICICI),
5. State finance corporations,
6. National Cooperative Development Corporation (NCDC),

NABARDs collaboration with other agencies

In its effort to develop the sector in a scientific manner the bank has been actively associating itself with the regional and international agencies like Network of Aquaculture Centers in Asia-Pacific (NACA). Asian Development Bank (ADB), International Development Association (IDA). Food and Agricultural Organization of United Nations (FAO), etc. Recently NABARD has been associated in a study on aquaculture sustainability and the environment sponsored by NACA/ADB/ GoI. Besides, the bank also collaborates with ICAR and other related research and development agencies on a continuing basis to remain up to date on the latest developments so as to prioritize for R&D support.

Area of financing in fisheries sector

NABARD promotes fisheries through 3 means,

1. Refinancing support,
2. Introduction of new technologies,
3. Research and Development.

Refinancing support

Gives financial assistance indirectly through Cooperatives, RRBs, CBs, and others. Apart from this NABARD also extends guidance to banks and entrepreneurs in formulating and implementing projects. It supplies model schemes to banks, conducts appraisal, monitoring and evaluation studies of projects.

Marine sectors

Traditional crafts and gear – catamarans, canoes, plank built boats with nets,
Mechanized vessels like – Trawlers, Gill netters, Purse seiners, Long liners and Double rig trawlers,
Motorization- replacement of engines.

Inland sectors

Traditional boats and nets, Carp hatchery, Composite fish farming, Integrated fish farming, (Paddy cum fish culture, Poultry cum fish culture, Piggery cum fish culture,

Dairy cum fish farming, Duck cum fish culture, Plantation horticulture cum fish farming, Air breathing fish culture) Fish seed rearing, Red tilapia culture, Running water fish culture, Semi-intensive carp culture, Freshwater prawn farming, Ornamental fish breeding and rearing, Fresh water pearl culture and Cage culture.

Coastal aquaculture

Shrimp hatchery, Shrimp farming, Brackish water fish farming, Mussel culture, Marine pearl culture, Clams culture, Mud crab culture and Cage culture.

Others

Feed mills, Processing plants, IQF plants, Surimi production, Rural infrastructure-fishing jetties.

Future possibilities

Finfish culture, Bivalve culture and Sea weed culture in coastal waters.

NABARD has been reviewing its policies from time to time keeping

In view the national priorities. In early eighties major share of bank finance was allotted to marine capture fisheries but latter the attention was shifted to freshwater aquaculture and setting up of hatcheries. Now with the advancement of technical knowledge and standardization of technologies, newer areas like shrimp farming, integrated fish culture projects, Mari culture etc., are being brought under the purview of institutional finance.

Cooperative banks and RRBs disburse more than 50% of credit.

Production of new technologies

Introduction of new technologies in fisheries development in association with other developmental agencies such as state government, ICAR institutes, Agricultural Universities. Some of them are as follows;

Paddy cum fish culture, Wheat cum fish culture, Running water fish culture, Intensive carp culture with the use of aerators, Use of treated domestic and Industrial effluent for fish culture, Giant freshwater prawn culture and hatcheries, Super intensive tilapia culture, Use of partial re-circulating system, Ornamental fish breeding, Value addition through processing techniques like individual quick freezing, Cage culture in open seas, Pearl oyster culture, Sewage fed fisheries, and Mussel culture.

Research and Development

To acquire new insights it is imperative that in depth studies and research are carried out. NABARD being development-oriented organization has a special fund called R & D fund for supporting year marked research projects. The main objectives of this fund is

To promote research in areas those are of primary interest to national bank,

To support research and action oriented projects in the area of rural development.

To assist and strengthen the efforts in project preparation, appraisal, monitoring and evaluation.

During 1998-99 the Bank has allotted Rs 55 lakhs in grants for research on standardization and commercialization of technologies for the fisheries sector. NABRAD also organizes seminars, conferences, and workshops for discussing strategies of fisheries development. These national conferences are attended by scientists, bankers, executives, who are all brought on common platform so that bottle necks in implementation of fishery projects can be removed and new approaches to the developments can be worked out.

Monitoring ongoing project

In order to extend qualitative lending's and improve its performance, it is prerequisite to know the post investment development in the fields and therefore monitoring studies are conducted by NABARD in association with financing banks.

Based on pre and post investment monitoring, necessary modifications in project formulation and implementation are undertaken. Such studies are conducted taking into consideration technical, economical, commercial, managerial and social aspects.

Based on the findings of these monitoring studies guidelines are circulated.

Bay of Bengal Project (BOBP) and NABARDs role

BOBP under FAO successfully implemented a pilot project that combined the features of commercial and development banking. These features of project implementation were taken into consideration by NABARD for its further activities.

About project

It was carried out from 1982 to 1984 in 4 coastal districts in Orissa. Credit valued Rs 6.5 mill in the form of boats, nets, and bicycles for marketing were distributed through 29 branches of 9 national banks to 2500 fisher folk households. The loan was without any subsidy at the prevailing interest rate of 12.5% and refinanced by NABARD.

The project has set an example by establishing direct enduring links between the marine fisher folk and the banks . IT also demonstrated that bank credit to artisanal fisher folk can be viable and recoverable by achieving 95% loan repayment.

Lending operations

Fisheries financing started almost four decades ago for small boats and nets in the marine side but for a fillip after the introduction of World Bank assisted Marine fisheries and inland fisheries programs during seventies and eighties. It reached a peak during early nineties after economic liberalization and introduction of shrimp farming. The trend of ground level disbursements in the first three years of the 9th plan indicates a growth rate of 23% during 98-99 from 97-98 and increase during 99-2000 over the previous year. The actual ground level disbursements in the first three years of the plan period are as follows;

1997-98	—	Rs338 Crores,
1998-99	—	Rs 443 Crores,
1999-2000	—	Rs 508 Crores,
2000-2001	—	Rs 584 Crores (Projected)
2001-2002	—	Rs 672 Crores (Projected)

The schematic refinance disbursement of NABARD under fisheries sector has generally shown an increasing trend up to the year 1995-96. Subsequently, 1996-97 onwards there was decline in disbursement. The details of the schemes sanctioned and refinance disbursed in the last decade by NABRARD is as follows;

Year		Rs in lakhs
1989-90	—	974
1990-91	—	1326
1991-92	—	2119
1992-93	—	3099
1993-94	—	5520
1994-95	—	10070
1995-96	—	10714
1996-97	—	4059
1997-98	—	3262
1998-99	—	2969
1999-2000	—	2683

The physical units financed and completed through NABARD assistance as on 31 march 2000 are as follows;

Mechanized boats	—	20774 nos,
Other boats	—	71004 nos,
Brakishwater aquaculture	—	4696 ha
Freshwater aquaculture	—	264000 ha

Disbursement under the fisheries sector generally showed an increasing trend until the year 1995-96. After which it was in declining phase in amount and no of loans. May be due to

- Introduction of agriculture and rural financing in large scale,
- Environmental and disease problems faced by shrimp farming,
- Initial interim order and uncertainties of the final judgment on shrimp aquaculture by Supreme Court,
- Slow progress in Mari culture.
- Mari culture disbursement not included in this report, which is, treated as separate area from 1995-96 onwards.

State wise Andrapradesh has been in the forefront of refinance disbursement. During shrimp farming crisis land locked states occupied the second and third position. In 1998-99 it is Kerala and Karnataka in 2nd and 3rd position respectively.

Problems in fisheries financing

Fisheries has vast untapped potential for development, has good technical and scientific manpower and entrepreneurship and is also getting due priority at the national level, however, the sector is progressing as desired by planners. This due to the following constraints;

General

- Lack of coordination among different agencies,
- Lack of extension facilities,

Marine

- Poor Policy for deep sea,
- Lack of conservation measures,
- Lack of new vessels for various depth zones,
- Lack of good fishery infrastructure,
- Unhygienic conditions,
- Lack Processing facilities,
- Lack of marketing set-up,
- The profitability of mechanized fishing vessels has been affected due to high cost of operations especially that of diesel and spare parts
- Dependence on moneylenders by fishermen who meet their working capital.

Inland

- Complicated Leasing policy,
- Non-availability of quality fish seed and feed,
- Non adoption of alternative species culture,
- Less contribution from reservoir fisheries,
- Ignorance of prawn farming,
- Not adopting innovative technologies,
- Lack of coordination.

Coastal aquaculture

- Coastal regulation zone and related problems,
- Demarcation of high tide line,
- Not trying alternative species culture,
- Disease problems,
- Poor leasing policy.

Banks

- Lack of awareness of the programs,
- Lack of coordination and monitoring,
- Lack of Insurance,
- Bad experience of banks,
- Shortage of trained staff in bank as well as implementing agency is considered a major handicap in quick processing/sanctioning of loan cases.

Remedial measures to improve fisheries finance

1. Importance to motorization of traditional crafts,
2. More onboard, on coast facilities for handling large number of marine catches,
3. Regulated fish markets for assured fish price,
4. Incentives for diversified fishing,
5. Relief from excise duty for fund,
6. Technical and extension support to banks and FFDA,
7. Suitable leasing policy for brackish water fish culture development.

Commercial Banks

The availability of funds from the commercial banks to the fishing industry can be divided into medium and short-term finances.

State Bank of India

SBI has started self-liquidation financing scheme. The SBI scheme (locally known as The Ratnagiri Scheme) is one of the most popular schemes of SBI.

Other commercial banks

The rapid progress made by the SBI induced other commercial banks also, particularly in Cochin and Bombay area. Unlike SBI these banks do not have any standard self-liquidating financing scheme but rely mainly on collateral vessel and personnel securities, comparative personal securities, comparative merits of the projects and credit of the borrowers.

Various loan schemes of commercial banks

Pledge loan

Pledge loans are another form of medium loans advanced by commercial banks (including SBI) to the fishing industry like any other industry. They are of different kinds such as lock and key advances, factory type advances and 'mandi' type advances at various interest rates.

Pledge loans are normally advanced for a period varying from three to five years. When perishable assets are pledged however the term is much shorter. When the loan is for the construction of processing facilities the term may be for as long as to 10 years.

Packaging credits (Short term loans)

The short-term credit supplied by commercial banks to the fishing industry consists of packaging credits and others. Packaging credits are need based and not security oriented and is advanced normally against a letter of credit for a period upto 180 days at a particular interest rate. Packaging credits are very helpful in procuring and processing the raw materials. It is very popular among fishery processors especially at Cochin.

Other short-term credits

Like other industries the Indian fishing industry also takes advantage of normal commercial bank shot term financing facilities in connection with purchase and collection of cheques and bills and overdrafts.

Specialized financing organization

A large no of specialized organization have been recently set up to provide financial assistance to industrial projects. They are

Industrial Development Corporation (IDC),
Industrial Development Bank of India (IDBI),
Industrial Finance Corporation of India (IFCI),
State Finance Corporation (SFC),
Industrial Credit and Investment Corporation of India (ICICI),
Export Credit Guarantee Corporation (ECGC).

Other Institution's financial involvement in fisheries

(During shrimp boom that is early 1990s)

Table 34: Schemes by different financing institution

Financing institution	No of schemes	Bank loan in crores	Disbursement in crores
IDBI	11	44.28	40.47
IFCI	8	81.88	72.84
ICICI	8	72.19	66.37
SCICI	13	69.80	58.00
Commercial banks	39	27.35	23.47
Total	79	619.38	468.449

CHAPTER 19

SUBSIDIES IN FISHERIES

Introduction

A Subsidy is a payment, which is made by the government (or possibly by private individuals), which forms a wedge between the price consumer's pay and the cost incurred by the producers such that the price has been less than marginal cost. Protection to home industries is granted by giving subsidies to the domestic producers. Especially when the cost of production high and domestic products are incapable of either competing with foreign goods or sell goods at a cheaper rate, the government may give them subsidies in the form of tax exemptions, development rebate or tax remittances or a segment of the cost of production may be also be borne by the state. Further inorder to encourage the exporters they be given export bounties. Export bonuses or bounties in effect artificially bring down the domestic price of goods to be exported and thereby the exporters will be in a position to sell them at a lower price in the foreign market. Thereby steeping up exports. So generally all subsidies tend to reduce the imports and increase the exports thus resulting in diversion of resources from more efficient to less efficient users.

Subsidies are given both by the government and the multinational agencies. The important agencies giving subsidies are MPEDA, NABARD and GOI

MPEDA

The MPEDA came into existence in 1972 under the Marine Products Export Development Act 1972 (No13 of 1972). The role envisaged for the MPEDA under the statute is comprehensive – covering fisheries of all kinds, increasing exports, specifying standards, processing, marketing, extension and training in various aspects of the industry.

MPEDA offers grants and subsidies to the industry from its own resources and recommends concessions and credits from other institutions. it offers funds for airlifting samples of new products to new markets. It orgaasuarinplies of inputs like mafron gas, refrigerated units for frozen cargo vessels etc. MPEDA prepares feasibility reports on processing plants, cold storages, fishing vessels on the basis of which entrepreneurs can obtain finance from commercial banks and other institutions. It makes recommendations to the Government of India on the import- export policy for the fishery industry and formulate incentive schemes.

Table 35: MPEDA subsidy schemes for seafood processors

Sl. No	Name of the scheme	Objective	Rate of assistance
1	Subsidy for automatic flake/ chip tube ice making machine.	To assist seafood processors to install machines for production of quality ice required for in - plant use.	25% of the cost of the machine subject to a maximum of Rs 2.00 lakh.
2	Subsidy for generator sets.	To assist the seafood processing units to have a capacity power as a stand by.	25% of the cost of generator set or Rs 2.50 lakh whichever is less.
3	Subsidy for upgrading deficient cold storage.	To enable seafood processors to upgrade their storage so as to maintain optimum temperature.	25%for improving insulation and 255 for upgrading the existing diffusers, subject to a maximum of Rs 3.5 lakhs.
4	Subsidy for acquisition of all processing machinery and equipments for production of value added marine products.	To assist seafood processors to acquire machinery and equipments for production of value added marine products.	25%of the cost of machinery and equipment, subject to maximum of Rs 15.00 lakhs.
5	Subsidized distribution of insulated fish boxes.	For proper preservation of raw materials in iced condition on board fishing vessel, in shrimp farms, peeling sheds and processing plants.	Moulded synthetic insulated fish boxes of various capacity are distributed at 50% subsidy/maximum limit
6	Interest subsidy assistance for seafood units to facilitate up gradation.	To subsidize a part of the interest payable by the plant owners to their bank/ financial institutions for the loans availed by them for modernization of their plant to achieve conformity to EU standards.	The subsidy eligibility will be restricted to a maximum of 7% of the interested charged by the bank/financial institutions over and above the international interest 7% or actual rate of interest over and above the international interest i.e. 7% whichever is less.

7	Assistance for establishment of chill room facility in seafood processing plants.	To assist seafood processors to set up chill room facilities in their processing plants for preserving the quality of the raw material at proper temperature starting from harvest till processing.	25% of the cost of establishment of chill room facility subject to a maximum of Rs 3.00 lakh per chills room and the assistance would be available for a maximum of 2 chill rooms in a processing unit.
8	Assistance for installation of Water Purification System in seafood processing plants.	To assist seafood processors to establish suitable Water Purification Systems in their processing plants for achieving equivalency to EU norms with regard to water quality.	25% of the cost of installation of Water purification System subject to a maximum of Rs 2.50 lakh per unit.
9	Assistance for setting up of Effluent Treatment plants in seafood processing plants.	To encourage seafood processors to provide effective Effluent Treatment Plant in their processing units for achieving equivalency to EU norms.	25% of the cost of setting up of Effluent Treatment Plant subject to a maximum of Rs 7.00 lakh per unit.
10	Financial support for acquisition of refrigerated truck/ containers.	To encourage seafood processors to acquire Refrigerated trucks/ Containers for the transportation of raw material/ finished products.	25% of the cost of refrigerated truck/ Container subject to a maximum of Rs 3.5 lakh.
11	Subsidy for setting up Mini Laboratory	For effective implementation of in process quality control.	50% of the cost of mini laboratory to a maximum of Rs 0.5 lakh per unit.
12	Assistance to seafood processors to establish captive pre- processing plants with upgraded facilities.	To bring the per-processing activities under the control of processors and upgrade the facilities on par with HACCP/ EU regulations	50% subject to a maximum of Rs 15 lakhs for new construction of pre-processing plants, which is also linked with the capacity of workers that can be employed. In the case of renovation, the subsidy is 90% of the cost of new construction i.e. subsidy on par with new units subject to reduction of a flat 10%.

Table 36: MPEDA Subsidy schemes for aquaculture

Sl. No.	Name of the scheme	Objectives	Quantum of subsidy
A	Subsidy for new farm development	For development of new prawns\ shrimps farms	@ 25% of the capital cost subject to a maximum of Rs 30,000 per hectare water area restricted to Rs 1.5 lakh per beneficiary
B	Subsidy for small scale hatcheries	For setting up shrimp hatchery with a minimum production capacity of 10 million seeds per annum	Subsidy @ 15% of the capital cost or Rs 1.5 lakh for the private hatcheries, 25% or Rs 2.5 lakh to co- operative sector and Rs 5.00 lakh for Govt sector.
C	Subsidy for medium scale hatcheries	For setting up of shrimp hatchery with a minimum production capacity of 30 million seeds per annum.	Subsidy @ 25% of the capital cost subject to Rs 5.00 lakh per beneficiary/ hatchery
D	Subsidy for setting up PCR labs in hatchery	To establish PCR in hatcheries.	Subsidy @ 50of the capital cost subject to Rs 5.00 lakh per beneficiary/ hatchery
E	Subsidy for effluent treatment system	To set up effluent treatment system attached to shrimp farms.	Subsidy @ 25% of the capital cost, subject to Rs 1.5 lakh for shrimp farms with a minimum water of 5.00 hectare and up to Rs 6.00 lakh per beneficiary.
F	Subsidy for establishment of chill room facilities in shrimp/ prawn farming areas.	To set up facilities for post harvest care of farm raised shrimp.	Subsidy @ 25% of the cost of establishment of chill room, subject to a maximum of Rs 3.00 lakh per beneficiary.

NABARD

Reserve bank of India was established in 1935 with a mandate to set up agricultural credit department with expert staff. Then came Agricultural Refinance Corporation (ARC) in 1963. It was renamed as Agricultural Refinance and Development Corporation (ARDC) in 1972. Then a committee called CRAFLCARD formed in 1979 and reviewed the credit structure and recommended formation of NABARD. Then NABARD Act was passed on 12/6/1982 and NABARD was established with initial capital of Rs 100 crores. It is an apex refinancing agency for the institutions providing investment and production credit for promoting the various developmental activities in rural areas but it should be noted that as such no subsidies is given by any bank.

Interest rate

Earlier interest is at the rate of 6.5% to 8% for banks. Other beneficiaries have to pay a rate of 10-12.5% rate. That is small farmers 10% and others 12.5%

Now, for beneficiaries,

Up to Rs 7500	—	11.5%
Rs 7500 – 25000	—	13.5%
Rs 25000 – 0.2 mill	—	15%
Rs 0.2 mill & above	—	16.5%
100% export oriented loan	—	15%

For banks 4% less in each category

Margin money

Small and medium farmers	- 5-15% of total outlay,
Large and corporate bodies	-25%
Deep-sea	-25%.

Beneficiaries

Individuals, Group of progressive entrepreneur, fishermen cooperative societies, fishermen federations, state fisheries development corporations and also private companies.
Other agencies provide credit to fisheries sector through NABARD refinances are as follows;

1.Industrial Finance Corporation of India (IFCI),
2.Industrial Development Bank of India (IDBI),
3.Shipping Credit and Investment Company of India (SCICI),
4. Industrial Credit and Investment Corporation of India (ICICI),
5.State finance corporations,
6.National Cooperative Development Corporation (NCDC),

NABARDs collaboration with other agencies

In its effort to develop the sector in a scientific manner the bank has been actively associating itself with the regional and international agencies like Network of Aquaculture Centers in Asia-Pacific (NACA), Asian Development Bank (ADB), International Development Association (IDA), Food and Agricultural Organization of United Nations (FAO), etc. Recently NABARD has been associated in a study on aquaculture sustainability and the environment sponsored by NACA/ADB/ GoI. Besides, the bank also collaborates with ICAR and other related research and development agencies on a continuing basis to remain up to date on the latest developments so as to prioritize for R&D support.

Area of financing in fisheries sector

NABARD promotes fisheries through 3 means,
1.Refinancing support,
2.Introduction of new technologies,
3.Research and Development.

Refinancing support

Gives financial assistance indirectly through Cooperatives, RRBs, CBs, and others. Apart from this NABARD also extends guidance to banks and entrepreneurs in formulating and implementing projects. It supplies model schemes to banks, conducts appraisal, monitoring and evaluation studies of projects.

Marine sectors

Traditional crafts and gear – catamarans, canoes, plank built boats with nets,

Mechanized vessels like – Trawlers, Gill-netters, Purse seiners, Long liners and Double rig trawlers,

Motorization- replacement of engines.

Inland sectors

Traditional boats and nets, Carp hatchery, Composite fish farming, Integrated fish farming, (Paddy cum fish culture, Poultry cum fish culture, Piggery cum fish culture, Dairy cum fish farming, Duck cum fish culture, Plantation horticulture cum fish farming, Air breathing fish culture) Fish seed rearing, Red tilapia culture, Running water fish culture, Semi-intensive carp culture, Freshwater prawn farming, Ornamental fish breeding and rearing, Fresh water pearl culture and Cage culture.

Coastal aquaculture

Shrimp hatchery, Shrimp farming, Brackish water fish farming, Mussel culture, Marine pearl culture, Clams culture, Mud crab culture, and Cage culture.

Others

Feed mills, Processing plants, IQF plants, Surimi production, Rural infrastructure-fishing jetties.

Future possibilities

Finfish culture, Bivalve culture, and Sea weed culture in coastal waters.

NABARD has been reviewing its policies from time to time keeping in view the national priorities. In early eighties major share of bank finance was allotted to marine capture fisheries but latter the attention was shifted to freshwater aquaculture and setting up of hatcheries. Now with the advancement of technical knowledge and standardization of technologies, newer areas like shrimp farming, integrated fish culture projects, Mari culture etc., are being brought under the purview of institutional finance.

Cooperative banks and RRBs disburse more than 50% of credit.

Introduction of new technologies

Introduction of new technologies in fisheries development in association with other developmental agencies such as state government, ICAR institutes, Agricultural Universities. Some of them are as follows;

Paddy cum fish culture, Wheat cum fish culture, Running water fish culture, Intensive carp culture with the use of aerators, Use of treated domestic and Industrial effluent for fish culture, Giant freshwater prawn culture and hatcheries, Super intensive tilapia culture, Use of partial re-circulating system, Ornamental fish breeding, Value addition through processing techniques like individual quick freezing, Cage culture in open seas, Pearl oyster culture, Sewage fed fisheries, and Mussel culture.

Research and Development

To acquire new insights it is imperative that in depth studies and research are carried out. NABARD being development-oriented organization has a special fund called R & D fund for supporting year marked research projects. The main objectives of this fund is

To promote research in areas those are of primary interest to national bank,

To support research and action oriented projects in the area of rural development.

To assist and strengthen the efforts in project preparation, appraisal, monitoring and evaluation.

During 1998-99 the Bank has allotted Rs 55 lakhs in grants for research on standardization and commercialization of technologies for the fisheries sector. NABRAD also organizes seminars, conferences, and workshops for discussing strategies of fisheries development. These national conferences are attended by scientists, bankers, executives, who are all brought on common platform so that bottle necks in implementation of fishery projects can be removed and new approaches to the developments can be worked out.

Monitoring ongoing project

In order to extend qualitative lending's and improve its performance, it is prerequisite to know the post investment development in the fields and therefore monitoring studies are conducted by NABARD in association with financing banks.

Based on pre and post investment monitoring, necessary modifications in project formulation and implementation are undertaken. Such studies are conducted taking into consideration technical, economical, commercial, managerial and social aspects.

Based on the findings of these monitoring studies guidelines are circulated.

Bay of Bengal Project (BOBP) and NABARDs role

BOBP under FAO successfully implemented a pilot project that combined the features of commercial and development banking. These features of project implementation were taken into consideration by NABARD for its further activities.

About project

- It was carried out from 1982 to 1984 in 4 coastal districts in Orissa. Credit valued Rs 6.5 mill in the form of boats, nets, and bicycles for marketing were distributed through 29 branches of 9 national banks to 2500 fisher folk households. The loan was without any subsidy at the prevailing interest rate of 12.5% and refinanced by NABARD.

The project has set an example by establishing direct enduring links between the marine fisher folk and the banks. It also demonstrated that bank credit to artisanal fisher folk can be viable and recoverable by achieving 95% loan repayment.

Lending operations

Fisheries financing started almost four decades ago for small boats and nets in the marine side but for a fillip after the introduction of World Bank assisted Marine fisheries and inland fisheries programs during seventies and eighties. It reached a peak during early nineties after economic liberalization and introduction of shrimp farming. The trend of ground level disbursements in the first three years of the 9th plan indicates a growth rate of 23% during 98-99 from 97-98 and increase during 99-2000 over the previous year. The actual ground level disbursements in the first three years of the plan period are as follows;

1997-98	—	Rs338 Crores,
1998-99	—	Rs 443 Crores,
1999-2000	—	Rs 508 Crores,
2000-2001	—	Rs 584 Crores (Projected)
2001-2002	—	Rs 672 Crores (Projected)

The schematic refinance disbursement of NABARD under fisheries sector has generally shown an increasing trend up to the year 1995-96. Subsequently, 1996-97 onwards there was decline in disbursement. The details of the schemes sanctioned and refinance disbursed in the last decade by NABRARD is as follows;

Year		Rs in lakhs
1989-90	—	974
1990-91	—	1326
1991-92	—	2119
1992-93	—	3099
1993-94	—	5520
1994-95	—	10070
1995-96	—	10714
1996-97	—	4059
1997-98	—	3262
1998-99	—	2969
1999-2000	—	2683

The physical units financed and completed through NABARD assistance as on 31 march 2000 are as follows;

Mechanized boats	—	20774 nos.
Other boats	—	71004 nos.
Brackish water aquaculture	—	4696 ha
Freshwater aquaculture	—	264000 ha

Disbursement under the fisheries sector generally showed an increasing trend until the year 1995-96. After which it was in declining phase in amount and no of loans. May be due to

- Introduction of agriculture and rural financing in large scale,
- Environmental and disease problems faced by shrimp farming,
- Initial interim order and uncertainties of the final judgment on shrimp aquaculture by Supreme Court,
- Slow progress in Mari culture,
- Mariculture disbursement not included in this report, which is, treated as separate area from 1995-96 onwards.

State wise Andrapradesh has been in the forefront of refinance disbursement. During shrimp farming crisis land locked states occupied the second and third position. In 1998-99 it is Kerala and Karnataka in 2nd and 3rd position respectively.

Table 37: Subsidies schemes provided for aquaculture (Shared by Indian government & state government)

Description	Rates
1. Construction of new ponds and tanks in beneficiaries own land with proper-screened inlet, outlet and shallow tube well.	Rs.2.0 lakh/ha in the plain areas. Subsidies @20% with a maximum ceiling of Rs.40, 000/ha for all farmers except SC/St for whom it is Rs.50000/ ha (25%). Rs .3.0 lakh/ ha in the hill states/districts and North - eastern region Subsidies @20% with a maximum ceiling of Rs.37500/ha for all farmers except SC/St for whom it is Rs.46875/ ha (25%).
2. Reclamation / renovation of ponds/ tanks	Rs.60, 000/ha Subsidies @20% with a maximum ceiling of Rs.12, 000/ha for all farmers except SC/St for whom it is Rs.15000/ ha (25%).

3. First year inputs (fish seed, feed, fertasuarinasnures, and preventive measures for fish diseases (eus))	Rs.30, 000/ha Subsidies @20% with a maximum ceiling of Rs.6, 000/ha for all farmers except SC/St for whom it is Rs.7500/ ha (25%).
4. Running water fish culture in hilly areas	Rs.20, 000/unit of 100 sq. meters. The above cost includes Rs 4000 towards inputs Subsidies @20% with a maximum ceiling of Rs.4, 000/unit for all farmers except SC/St for whom it is Rs.5000/unit (25%).
5. Integrated fish farming	Rs.80, 000/ha Subsidies @20% with a maximum ceiling of Rs.16, 000/ha for all farmers except SC/St for whom it is Rs.20000/ ha (25%).
6. Setting up of integrated units including hatcheries for ornamental fishes.	2) U cost is Rs 15 Lakhs for a hatchery of 5-10-million fry/year capacity. Subsidies @10% with a maximum ceiling of Rs 1.5 lakhs to all categories of fish farmers.
7. Establishment of laboratories at state level for water quality and fish health investigations.	1) U cost is Rs 30. Lakh (for the construction of building-25lakh, for equipment, glassware & chemicals-Rs 5 lakh). This is one time grant to the states for state level. Operational cost would be met by the respective states.
8. Provision of soil and water testing kits to each FFDA.	Unit cost of each soil and water testing kit is for R s 30000. The kits are sanctioned once to each FFDA as one time grant.
Aerators / pumps	Rs.20, 000/unit of two 1 hp aerators/ one 5hp diesel pump Subsidies @25% with a maximum ceiling of Rs.12500/unit for each set of aerators / pumps for all categories of aerators /pumps for all categories of farmers who have attained a level production of 3000 kg / ha / year and raise it further .a maximum of 1hp aerators /one 5hp diesel pump one ha water- area is admissible.
9. Establishment of big fresh water prawn hatchery at state level (one in each concerned state) and small hatcheries to beneficiaries	1) Unit cost is Rs 30. Lakh for a big fresh water prawn hatchery with a capacity of 25 PL / year. This is one time grant to the states for establishment of hatchery at state level. 2) Unit cost is Rs 8. Lakhs for a small hatchery of 5-10 million PL/year capacities. Subsidies @ 20% with a maximum ceiling of Rs 1.5 lakhs to entrepreneurs only.

10. Fresh water fish seed hatchery	Rs.8.0 lakh for fish seed hatchery with a capacity 10 million in the plain areas. Rs .12.0 lakh with same capacity in the hill states/districts and North - ea–tern region Subsidies @10% with a maximum ceiling of Rs 80000 in the plains & Rs 1.2 lakh in the hilly areas for entrepreneurs only.
11. Transportation of fish / prawn seed	This will be applicable only for the hill states/districts and northeastern region. Subsidies @ Rs 20 for 1000 fry transported to all FFDA'S not applicable to individual fish farmer .
12. Fish feed units	Unit cost is Rs 25 lakh for building machinery and equipment. These will be set up in the private sector. Subsidies @20% with a maximum ceiling of Rs 5.0 lakh.
13. Training of fish farmers	Stipend @ Rs .50 /day during training period of 10 days and lump sum of Rs 100 towards travel and field visits.
14. Purchase of vehicles	50% of cost of vehicle for each new and 50% cost for the replaced vehicle.

Under BFDA PROGRAMME for extensive / semi intensive shrimp culture.

15. Capital cost on pond development & cost of input for first crop	Rs 30000/ ha (max holding size -10 ha) Subsidies @ 25%
17. Small scale/ back yard shrimp hatchery with 2-5 million seed production/annum	Rs 100000/unit. Subsidies @25%

The above assistance under FFDA programme is available only once to a beneficiary. Subsidy for the construction of new ponds and tanks, reclamation / renovation of ponds / tanks and first year inputs to an individual beneficiary for less than 1ha and upto 5ha is available with or without institutional finance in the plain areas and 1.0 ha in the hill states / districts on pro- rata basis. Above assistance in the form of subsidy is also available for developmental activities to the fishermen co -ope–ative societies through the national federation of fishermen's co-operatives.

CHAPTER 20

FISHERIES DEVELOPMENT PLANS AND POLICIES

Need for policies in fisheries

1. Fish is a depleting resource though earlier in 19th century it was thought as an inexhaustible resource
2. Fishing in territorial waters of other countries often led to conflicts (often referre as 'conflict waters')
3. Needed to conserve and preserve the fast depleting stocks and genomic diversity.
4. Needed to preserve the rights of traditional fishermen.

Policy recommendation

Policy and legal issues

1. To update the fisheries policy devised in 1898 and MPEDA Act, 1972 and also the central and state government acts in the present context of new development.
2. The National Water Research Council should take into consideration the promotion of fisheries by aquaculture development and conservation of aquatic resources. Sheltered bays suitable for mariculture should be leased under proper policies.
3. Increasing attention should be paid to environmental problems of coastal zones.

Financial support

4. As the income from fisheries is increasing at an alarming rate the government should give better recognition and greater investment for growth and sustenance.

Capture fisheries

5. Creation of fishing regulatory authority with powers of implementing sustainable fishing and is bestowed with legal powers.
6. Increased attention should be given to culture based reservoir fisheries, beels and upland lakes.
7. Suitable strategies for exploiting oceanic tuna and Antarctic krill will have to be developed.

Aquaculture

8. Integrate aquaculture with other sectors to give more profit.
9. To boost inland aquaculture scientific leasing policy of water bodies will have to be formulated to utilize them rationally.
10. To encourage the establishment of more fish -fee– manufacturing units the aquaculture industry must be granted a status of parity with poultry and cattle feed industries and waiver/tax concessions must be given.
11. A major constraint for the development of aquaculture is the loss due to microbial diseases causing acute and heavy mortality. Diagnostic laboratories with facilities for rapid detection

of pathogens by molecular methods such as PCR should be set up in all the fisheries colleges of India. Farmers should have easier access to labs to get the desired diagnosis, prophylactics, and suggestions at subsidized cost.

12. Intense anthropogenic activity and heavy pollutants have driven many aquatic organisms to endangerment. There is a need to priorities species and aquatic habits for conservation. Financial support for research on cryopreservation of fish sperm and cell lines has become important

Post -Harvest Technology

13. Large trawlers should be provided with additional storage facility for the by-catch of low value fish. Subsidies should be given for installation.

14. Fishermen should be encouraged to carry ice on board to preserve the harvest. Also create awareness about the hygienic handling of fish. Insulated container must replace the traditional bamboo baskets. Transport by air should be encouraged.

15. The major benefit of application of radiation in fishery products is now recognized and such facility should be established in at least two strategically important landing centers in each maritime state. (Each costs about Rs.75 million)

16. The public should be made aware of the health benefits of eating fish.

Fisheries education and research publications

17. Many qualified fisheries graduates remain under/unemployed; the government should give considerations to the national fisheries and state institutions to grow by filling the vacancies present.

18. Although fishery scientists have accomplished a commendable job to increase fish production in the country both the number and quality of their publications suffer at the international level due to poor visibility. An all-out effort must be undertaken to improve the image of the premier fisheries journal of ICAR viz. Indian journal of fisheries.

Plan schemes for fisheries development

1. Development of coastal marine fisheries

There are three components for this scheme, namely

a) Motorization of traditional craft,

b) Reimbursement of Central Excise Duty on HSD oil supplied to mechanized fishing vessels of length below 20 meters, and

c) Enforcement of marine fishing regulation acts and setting up of artificial reefs, etc.

2. Development of freshwater aquaculture

Development of freshwater aquaculture through the Fish Farmers' Development Agencies started in 1973-74. These agencies provide a package of technical, financial and extension support to the fish farmers. In order to boost inland fish production, assistance in the form of subsidy is given to fish farmers for construction of new ponds, reclamation/renovation of ponds and tanks, inputs for first year fish culture running fish culture, integrated fish farming, fish seed hatchery, fish feed mills, etc.

3. Integrated Coastal Aquaculture

The main objectives of BFDA's are

a) Provision of assistance to different categories of small scale shrimp farmers for establishment of shrimp farms and shrimp seed hatcheries

b) Establishment of demonstration-cum-training centres for imparting training to the shrimp farmers;

c) Introduction of training components under the BFDA programme for imparting training to the small-scale shrimp farmers.

4. Shrimp and Fish Culture Project

A shrimp and fish culture project for developing brackish water areas and reservoirs/oxbow lakes in the states of Andhra Pradesh, Bihar, Orissa, Uttar Pradesh and West Bengal became credit effective from 28th May, 1992.

5. Fishing harbour facilities at major and minor ports

Fishing harbours are being developed at both major and minor ports, in addition to construction of fish landing centres at a large number of sites. The objective of this scheme is to provide appropriate and adequate infrastructure facilities, viz., breakwaters, wharf, jetty, dredging reclamation, auction hall, slipway, workshop and navigation facilities for efficient operation of the large number of fishing vessels.

6. National welfare of fishermen

The objectives (i) to provide better living standards to fishermen and their families including provision of sanitation and drinking water facilities in fishermen villages, (ii) provision of social security to active fishermen and their dependents and (iii) economic security to fishermen during lean fishing season. This scheme has three components

i) lopment of Model Fishermen Villages

ii) Group Accident Insurance Scheme for Active Fishermen

iii) Saving-cum-Relief for Marine Fishermen

7. Strengthening of infrastructure for inland fish marketing

The objective of the scheme is to create facilities for providing remunerative price the fish farmers and making available fresh fish at reasonable price to consumer. Assistance is also being provided strengthening infrastructure facilities in the form of fish handling sheds, ice plants, cold storages, insulated/refrigerated transport vans, three wheelers, fish retail outlets/kiosks and bicycles with insulated boxes for retail marketing.

8. Assistance to coast guard

Since coast guard is authorized to monitor fishing by foreign vessels under the MZI act, 1981, the need was felt to strengthen their communication facilities by providing funds for them to set up ship to shore and vice-versa direct voice (radio) communication link with fishing vessels. Apart from this the link will also help the coast Guard in ensuring safety of the Indian owned vessels fishing at sea and in rendering any assistance required.

9. Fisheries Training and Extension

The main objective of the scheme is to provide training to fishery personnel so as to assist them to undertake fisheries extension programmes effectively. The scheme also provides assistance to fisher folk to upgrade their skills. Other components of the scheme are

i) To publish short, concise and useful manuals with a view to provide adequate extension material.

ii) Production of video films on the technologies developed by the Research Institutes/ Organizations.

iii) To conduct meeting/workshops/seminars, etc. which are of national importance and relevant to the fisheries sector.

10. Lopment Inland Fisheries Statistics

The programme was introduced with a view to evolve a standard methodology for collection of Inland fisheries statistics.

Development of fisheries during the five-year plans

Indian five year plans - hi–tory

Planning as an instrument of economic development in India goes back to the year 1934,when Sri. M.Visvesvaryya published his book "Planned Economy Of India". In 1938 the first attempt was made to evolve a national plan for India when the 'National Planning Committee 'was'set up under chairmanship of Pandit Jawaharlal Nehru. After independence in March 1950 the planning commission was set up by the Government of India under the chairmanship of Pandit Jawaharlal Nehru to prepare a plan for the most effective use of resources. In July 1951 the first plan period's[A'ril 1951 -Mar–h 1956] draft was prepared .It was in December 1952 that the final version of India's f'rst five year was presented to the parliament by the commission .

Objectives

The various objectives that run through the plans are to

1. increase national income and per capita income
2. raise agricultural production
3. industrialize the economy
4. achieve balanced regional development
5. expand employment opportunities
6. reduce inequalities of income and wealth
7. alleviation of poverty
8. achieve self reliance

In a broad sense, these specific objectives can be grouped into four basic objectives

1. Growth

The overall growth in terms of *GDP*.

2. Modernization

It refers to a variety of structural and institutional changes in the framework of economic activity. It includes fields like national income, industry, and agriculture.

3. Self reliance

It means a reduction in the dependence of foreign aid, diversification of domestic production and a consequential reduction in imports for certain critical commodities and promotion of exports to enable us to pay for imports from our own resources.

4. Social justice

It includes improvement of living standards of the people, alleviation of poverty, removal of unemployment and reduction in inequalities of income and wealth. The various measures towards achieving growth with social justice have been land reforms abolition of bonded labour liquidation of rural indebtedness fixation of minimum of wages for farm labour drive against economic offenders provision of basic minimum needs and measures towards reduction of concentration of incomes, wealth and economic power and of poverty and unemployment.

Indian Scenario

Fisheries development in India is coupled with the plans that were adopted by the government

First Five-Year Plan (1951-56)

Emphasis was mainly given on marine sector

a) Mechanisation of country crafts
b) Development of harbours
c) Market developments
d) Provisions for ice storage & transport
e) Provision for offshore fishing

- Intensive seed collection from spawning sites was the main threat in FW sector

Second five-year Plan (1956-61)

Marine sector

1. Improvements of fishing methods and mechasuarinasncrafts
2. Supply of nylon nets to fishermen
3. Provision of landing centre and harbour
4. Integration of fish transport, storage, marketing and utilization
5. Deep sea fishing

Inland sector

- Reservoir management and conservation
- Fish seed production and distribution

Third Five-Year Plan (1961-66)

Objectives

1. Increased fish production
2. Improved economic status of fishermen community
3. Development of export trade
4. Formation and operation of fisheries co-operatives
5. Expansion of freezer plants, e/s and canning plants

Table 38 : Plan budget and expenditure on fisheries from I – III five year plans

Plans	Total Expense (crores)	Agriculture And allied	Fisheries Approved	Actual
I (1951-56)	1960	241 (12.2%)	5.13 (0.261%)	2.78
II (1956-61)	4600	667 (14.5%)	12.26 (0.266%)	9.06
III (1961-66)	8777	1280 (14.9%)	42.3 (3.3%)	31.67

There were three interim annual plans from 1966-1969 with no special development in fisheries sector. The three annual plans were carried out, since the results of the three five year plans were not satisfactory. The intentions of the annual plans were to achieve the objectives of the III five-year plan.

Fourth Five-Year Plan (1969-74)

Major objectives

1. Increase productions of fishes to meet cheaper source of protein
2. Developing the export potential
3. Improving the socio- economic conditions of fishermen
4. Training in fisheries and utilization of institutional finance were emphasized.
5. Networking features of this period
6. Abolition of licensing the crafts
7. Distribution of Taccavi loans (short term loans) to needy fishermen
8. Provision of loan to fishermen co-operatives with subsidy
9. The agricultural refinance corporations and IDBI started finding some fisheries schemes

Budgetary allocations (in crores)

Total expenses	15779
Agricultural / allied	2210 (14%)
Fisheries (Approved)	82.68 (0.524%)
(Actual)	54.11

Fifth Five-Year Plan (1974-79)

It had two important viewpoints

1. Productions programme Intended to explore and exploit (economically) the national fishery resource

2. New food programme

To reach out to the weaker section (with lens buying power) with better quality protein at cheaper prices.

Strategies

1. To encourage private sector to take up deep-sea fishing (Import D.S.F.V)
2. To increase number of farms for increased fish production and to enhance F.W prawn culture.

Strategies for betterment of fisherman community

a) Development of appropriate technology
b) Provision of share capital through co-operatives
c) Marketing & processing facilities
d) FFDA's w're established

Exploratory Surveys

75 vessels from 12 bases carried out surveys in 2.8-lakh sq km along both the coasts.

Budget allocation

Total	39322.00
Agricultural / allied	4302.00 (11%)
Fisheries (Approved)	151.24 (0.38%)
(Actual)	134.98

Sixth Five-Year Plan (1980-85)

Objectives

- Increase in production in both Marine & Inland sector
- Extension intensification
- Need for extension in Indian inland Sector (Aquaculture) was studied in this plan period.
- Intensive resource assessment surveys in marine sector / optimum exploitation
- Intensification of processing, marketing & value additions

Budgeting allocation (in Rs. Crores)

Total	97500.00
Agriculture	12539.00 (13%)
Fisheries	371.14 (0.3%)

Seventh Five-Year Plan (1985-90)

Marine sector strengthening strategies

- Exploitation of EEZ through higher investment in deep sea fishing (beyond 40 fathoms).
- Diversification of fishing methods
- New gears were introduced
- FRP & Ferro cement boats
- Laws were enforced to avoid conflicts between traditional fishermen and mechanized boaters
- Suggested having small landing centres for traditional fishermen
- Insurance welfare schemes for fishermen.

- Value addition in domestic fishing products
- Proposal for "hygienic fish market" through a chain of integrated cold chain of whole sale & retail outlets perfeçtly under co-operative sector
- Fisheries industrial estates
- FSI & CIFNET were re-organized & strengthened during plan span.
- Intensification of inland cultures in tanks through the help of FFDA.

From I to VII Five year plan

Total fish production - 7.25 lakh tones to 31.5 lakh tones (319% increase)

Annual growth rate (till 1990) 4.06%

First time production achieved target levels = 3.67 mt (1990)

Marine sector 240%

Inland sector 543%

Hatcheries both indoors & outdoors enhanced seed production by 72% by end of 1990.

Boats 24000

Harbour 140

Allocation for fisheries in VIII plan = Rs. 500 Crores.

Eighth Five year plan (1992-1997)

- Promotion of inland sector to the highest extend special & separate emphasis were given to develop fresh water, brackish water and non-conventional water resources (like Ox-bow lakes)
- Wet land reclamation
- Promotion of maritime
- Conversation policies
- Closed seasons, closed areas, fisheries sanctuaries
- Welfare facilities for fishermen community
- Housing
- Financial assistances
- Sanitation
- Education in free for fishermen community

Achievements of 8th Five-year plan

Best for fisheries

Average annual growth rate	5.7% (from base year of VIII plan)
Shrimp seed	1000 million / year
Fish seed production	15,700m (1995)
Export earning crossed $ billion	(1995)
Total outlay for fisheries in 8th plan	Rs. 1172 crores.

Ninth Five year plan (1997-2002)

Objectives

Marine sector

- Enhancing production of fish and productivity of fishermen / fisherwomen / Fishing industry and thereby generating employment
- Increasing the percapita consumption to 11kg/hr from last plan periods 8kg/annum
- Integration of approach to marine & Inland taking into account of sustainable eco friendly aquaculture
- Conservation of aquatic resources and genetic diversity

Gears

- Enforcement of MFRA in states
- Inclusion of TED
- GIS in fisheries

Inland sector

- Increasing productivity of reservoirs
- Impact assessment of river valley projects on fisheries
- Ranching lagoons & rivers with seed reared from Hi tech hatcheries equipped with sophisticated laboratories.
- Cold water fishery hatcheries for Trouts, Mahseers & hills stream species

Extension

- Scientific extension programmes to be incorporated
- Adoption of model fishermen villages
- Development of inland Fishery statistics in states

Target production at the base year of IX Five-year plan (2002)

Growth rate in marine sector	3% annual
Growth rate in Inland sector	6% annual
Total fish production	6.37 m tons (present 5.2 mt)
Seed production (growth rate)	7%
Expected target (carp seed)	23000 million fry
Shrimp seed	16000 million PL (target)
Finfish fry	100 million (close to target)
Budget allocation	Rs.2070 crores

Thrust areas in tenth five-year plan (2002-07)

Capture fisheries

- Monitoring of exploited marine fish stocks
- Stock assessment of commercially important marine species
- Marine biodiversity, database, conservation & management
- Fisheries enhancement in inland open waters
- Catchment ecology in relation to fisheries
- Ecology and Fishery potential of canals
- Riverine hydrodynamics and fish behaviour
- Hill fishery resources assessment and management
- Development of sport fishery in hill areas
- GIS based inventory of aquatic resources
- Development of predictive models

Culture fisheries

- Breeding and culture of aquatic organisms
- Fish health management
- Fish nutrition and feed development
- Aqua farm engineering
- Integrated fish farming
- Environment Impact Assessment
- Cage / pen culture in large water bodies & floodplain wetlands.
- Development of pearl culture technologies
- Ornamental fish culture
- Coastal zone management

Fish genetic resources

- Cataloguing of germplasm resources and development of database
- Biodiversity repository
- DNA Fingerprinting of prioritized species
- Genetic improvement and Bio-technology
- Exotics and quarantine

Fishing and fish processing

- Fuel efficient vessels for offshore and deep sea fishing
- Eco-friendly and responsible fishing techniques for EEZ.
- Craft and gear design improvement for marine and inland waters.
- Handling and transportation of fish.
- Sanitation, hygiene and quality control.
- Processing, value addition, packaging and marketing.
- Waste utilization and by-products.
- Bioactive substances from aquatic plants and animals.
- Quality management and food security.
- Onboard and onshore equipments for fishing and fish processing.

Fishery education

- Awareness and training programmes in specialized areas of fisheries.
- Fishery informatics and database
- Vocational and distance education
- Socio-economics
- Extension and Transfer of Technology
- Information Technology and production of educational materials.

New initiatives

India Coordinated Research Projects

- Culture-based fisheries of small reservoirs
- Integrated management of inland saline waters
- Mariculture and sea ranching

Network Programmes

- Exotics and new candidate cultivable species
- Development of quarantine system
- Hill fisheries development
- Food safety and risk assessment

Reasons for failure of plans

1. Inadequate use of natural resources
2. Growth in population
3. Inadequate social development
4. Existence of inequalities
5. Increase in unemployment
6. Slow economic growth
7. Defective foreign trade policy
8. Increase in indebtedness
9. Increase in deficit financing
10. Defective planning

On-going AP cess funded schemes in fisheries

• Total Schemes in operation	126
• State Agricultural Univ. Covered	19
• ICAR Institutes Covered	12
• CSIR Institutes Covered	02
• Conventional Universities Covered	26
• States/UTs Covered	23
• Disciplines Covered	12

Table 39: Fish seed production – India

	Year	Production (million fry)
	1973-74 (End of IVth Plan)	409
	1978-79 (End of Vth Plan)	912
	1984-85 (End of VIth Plan)	9,639
VIIth Plan		
	1985-86	6,322
	1986-87	7,601
	1987-88	8,608
	1988-89	9,325
	1989-90	9,691
Annual Plan		
	1990-91	10,332
	1991-92	12,203
VIIIth Plan		
	1992-93	12,500
	1993-94	14.239
	1994-95	14.544
	1995-96	15,007
	1996-97	15,852
IXth Plan		
	1997-98	15,904
	1998-99	15,156

Source State Governments/Union Territory Administrations

Table 40: Outlays and expenditure for fisheries development over plans

Plan	Outlay/ Expenditure	Central sector schemes	Centrally sponsored schemes	State schemes	Total
First Plan	Outlay	1.00	@	4.13	5.13
	Exp.	0.38	@	2.40	2.78
Second Plan	Outlay	3.73	@	8.53	12.26
	Exp.	1.80	@	7.26	9.06
Third Plan	Outlay	6.72	@	21.55	28.27
	Exp.	3.03	@	20.29	23.32
Annual Plans (1996-69)	Outlay	15.30	@	26.91	42.21
	Exp.	9.04	@	23.63	32.67
Fourth Plan	Outlay	28.00	6.00	48.68	82.68
	Exp.	8.11	5.17	40.83	54.11
Fifth Plan	Outlay	51.05	17.00	83.19	151.24
	Exp.	39.93	4.07	71.21	115.21
Sixth Plan	Outlay	137.10	36.62	197.42	371.14
	Exp.	75.54	28.80	182.61	286.95
Seventh Plan	Outlay	156.58	60.75	329.19	546.52
	Exp.	116.93	53.26	307.40	477.59
Annual Plans (1990-92)	Outlay	25.45	55.16	212.13	292.74
	Exp.	16.48	43.73	211.90	272.11
Eighth Plan	Outlay	139.00	300.00	766.39	1205.35
	Exp.	161.01	268.02	689.43	1118.46
Ninth Plan	Outlay	240.00	560.00	1,269.78	2,069.78

@ Figures given under central sector include those of centrally sponsored schemes.

Note Figures for Seventh Plan include the figures for fishery survey of India and Trawler Development Fund which were transferred to Ministry of Food Processing Industries.

Table 41 : State sector schemes, fifth to eighth plan(Rs. Lakhs)

State/Union Territory	Seventh Plan		Eighth Plan	
	Outlay	Expenditure	Outlay	Expenditure
1. Andhra Pradesh	2,140.00	2,377.56	9,806.00	1,620.00
2. Arunachal Pradesh	1,000.00	1,717.42	565.00	735.00
3. Assam	25.00	247.93	2,285.00	2,789.00
4. Bihar	950.00	1,050.73	2,605.00	725.00
5. Goa	500.00	444.05	1,000.00	644.00
6. Gujarat	2,426.00	2,108.37	3,700.00	3,626.00
7. Haryana	750.00	679.34	1,506.00	1,277.00
8. Himachal Pradesh	430.00	329.67	800.00	1,058.00
9. Jammu and Kashmir	450.00	534.17	920.00	1155.00
10. Karnataka	2,000.00	1470.46	4300.00	8098.00
11. Kerala	4000.00	3294.41	10500.00	11337.00
12. Madhya Pradesh	1048.00	909.64	1708.00	2028.00
13. Maharashtra	1600.00	1783.90	2914.00	2736.00
14. Manipur	465.00	504.89	800.00	956.00
15. Meghalaya	180.00	201.49	350.00	413.00
16. Mizoram	100.00	174.10	225.00	334.00
17. Nagaland	300.00	351.79	650.00	571.00
18. Orissa	1260.00	2670.53	10464.00	5263.00
19. Punjab	598.00	536.76	1782.00	1048.00
20. Rajasthan	400.00	274.99	955.00	590.00
21. Sikkim	120.00	79.95	150.00	150.00
22. Tamil Nadu	2400.00	1467.94	3150.00	7817.00
23. Tripura	600.00	1149.86	2200.00	1883.00
24. Uttar Pradesh	1250.00	1239.74	2150.00	2380.00
25. West Bengal	6175.00	3917.40	7917.00	6164.00
26. Andaman and Nicobar Islands	405.00	150.98	1121.00	1387.29
27. Chandigarh	17.40	17.17	26.00	16.88
28. Dadra and Nagar Haveli	5.00	3.08	10.00	5.26
29. Daman and Diu		136.55	202.00	203.29
30. Delhi	80.00	49.34	60.00	73.10
31. Lakshadweep	520.00	327.15	938.00	817.31
32. Pondicherry	500.00	538.95	880.00	1042.63
Total	**32919.40**	**30740.31**	**76639.00**	**68942.76**

Table 42: Expenditure by states/ union territories for fisheries development during eighth plan.

(Rs. Lakhs). Source Planning commission.

State/Union Territory	Expenditure					
	1992-93	1993-94	1994-95	1995-96	1996-97	Total
1. Andhra Pradesh	268	670	164	220	298	1620
2. Arunachal Pradesh	114	133	148	170	170	735
3. Assam	268	630	643	581	667	2789
4. Bihar	160	92	155	196	122	725
5. Goa	116	177	136	110	105	644
6. Gujarat	575	560	628	832	1031	3626
7. Haryana	178	199	230	300	370	1277
8. Himachal Pradesh	157	142	160	212	387	1058
9. Jammu and Kashmir	171	180	257	260	287	1155
10. Karnataka	704	765	863	1025	4741	8098
11. Kerala	1125	1919	2605	3225	2463	1137
12. Madhya Pradesh	339	325	343	380	641	2028
13. Maharashtra	504	568	284	639	741	2736
14. Manipur	183	175	180	241	177	956
15. Meghalaya	67	89	70	78	109	413
16. Mizoram	45	58	55	76	100	334
17. Nagaland	42	123	65	179	162	571
18. Orissa	1043	978	774	1223	1245	5263
19. Punjab	207	172	226	196	247	1048
20. Rajasthan	105	117	115	110	143	590
21. Sikkim	25	24	27	41	33	150
22. Tamil Nadu	971	1177	1454	1435	2780	7817
23. Tripura	435	253	381	381	433	1883
24. Uttar Pradesh	370	465	497	545	503	2380
25. West Bengal	359	667	1408	1740	1990	6164
26. Andaman and Nicobar Islands	215	202	389	341	240	1387
27. Chandigarh	5	2	4	2	3	17
28. Dadra and Nagar Haveli	1	1	1	1	1	5
29. Daman and Diu	32	31	50	50	41	203
30. Delhi	19	17	18	0	18	73
31. Lakshadweep	94	204	163	155	202	817
32. Pondichery	166	200	184	249	244	1043
Total	**9063**	**11314**	**12677**	**15193**	**20694**	**68943**

Table 43: Ninth plan outlay and expenditure during 1997-98 and 1998-99 in the different states and union territories

State/Union Territory	Ninth Plan	Expenditure	
	(1997-2002)	1997-98	1998-99
1. Andhra Pradesh	5184	582	582
2. Arunachal Pradesh	1811	233	160
3. Assam	9976	1325	1000
4. Bihar	1000	229	100
5. Goa	792	103	133
6. Gujarat	10400	1298	1438
7. Haryana	1738	411	350
8. Himachal Pradesh	1450	245	296
9. Jammu and Kashmir	2750	417	442
10. Karnataka	11050	332	1786
11. Kerala	17608	4000	3450
12. Madhya Pradesh	4792	660	853
13. Maharashtra	4188	1039	720
14. Manipur	2000	240	200
15. Meghalaya	1400	155	90
16. Mizoram	450	100	85
17. Nagaland	2000	165	165
18. Orissa	5418	1724	1598
19. Punjab	1952	321	254
20. Rajasthan	770	150	88
21. Sikkim	200	41	34
22. Tamil Nadu	9984	1399	2715
23. Tripura	1988	331	287
24. Uttar Pradesh	2800	470	279
25. West Bengal	18713	4000	2652
26. Andaman and Nicobar Islands	2484	442	421
27. Chandigarh	500	7	5
28. Dadra and Nagar Haveli	11	2	1
29. Daman and Diu	322	104	92
30. Delhi	125	18	18
31. Lakshadweep	1552	258	286
32. Pondicherry	1500	206	204
Total	**126978**	**21007**	**20784**

Table 44: Profile of plan schemes for fisheries development, sixth plan - 1980-85.

	Scheme	Outlay	Expenditure
1.	Exploratory Fisheries Project now Fishery Survey of India (FSI)	4800.00	2157.77
2.	Integrated Fisheries Project (IFP)	285.00	618.07
3.	Central Institute of Fisheries, Nautical and Engineering Training (CIFNET)	700.00	848.81
4.	Coastal Engineering Project (now CICCEF)	75.00	51.36
5.	Fishing Harbour at Major Ports	1700.00	1320.08
6.	All India Fish Marketing Study	41.00	22.90
7.	Assistance of SDFC for Trawler Development Fund	5000.00	1922.05
8.	Strengthening of Organisation of Head Quarter	25.00	16.85
9.	Programmes for fish seed development	800.00	317.33
10.	Augmentation of Slipway facilities at Goa shipyard	165.00	-
11.	Pilot Project on reservoir fisheries with World Bank Assistance	19.00	18.60
12.	Development of Inland Fisheries Statistics	100.00	11.85
13.	Assessment of Marine Fisheries Resources Training	-	2.37
14.	Schemes for Wooden Hull	-	83.20
15.	Development of Small Scale Fisheries under Japanese Aid	-	162.00
16.	Development of Aquaculture (FFDA)	500.00	369.52
17.	Fishing Harbour at Minor Ports	1900.00	1795.10
18.	Establishment of Prawn Hatcheries and Prawn Farming	500.00	113.00
19.	Inland Fisheries Project with world bank assistance	762.00	522.76
20.	Techno-Socio Economic Survey of Fisheries Construction of Dry Dock	-	17.85
21.	Group Insurance Scheme for Active Fishermen	-	32.57
22.	Development of Botanical Garden near Fisheries Harbour	-	10.00
23.	Introduction of Beach Landing Crafts for small fishermen	-	19.46
	Total	**17,372.00**	**10,433.50**

Table 45: Profile of plan schemes for fisheries development, seventh plan - 1985-90.

	Scheme	Outlay	Expenditure
1.	Integrated Fisher Project IIFP)	700.00	490.93
2.	Central Institute of Fisheries Nautical Engineering and Training (CIFNET)	700.00	831.82
3.	Central Institute of Coastal Engineering for Fishery (CICEF)	75.00	95.91
4.	Training, seminar, etc.	50.00	32.07
5.	Fishery Harbours at Major Ports	1700.00	1684.40
6.	Development of Inland Fisheries Statistics	80.00	56.48
7.	National Fisheries Development Board	500.00	-
8.	Wooden Hull Trawler	30.00	-
9.	Strengthening of Technical Wing	160.00	30.19
10.	Fish Seed development programme	550.00	364.49
11.	Development of Freshwater Aquaculture	1550.00	1701.29
12.	Development of Derelict Water Bodies	165.00	112.00
13.	Development of Reservoir Fisheries	400.00	14.35
14.	Development of Coastal Marine Fisheries i) Introduction of improved beach landing craft	300.00	278.84
15.	Integrated Brackish water Fish Farm Development	500.00	479.93
16.	Minor Fishery Harbours Including Fisher Industrial Estates	1900.00	2168.86
17.	Welfare Scheme i) Group accident insurance scheme for active fishermen	150.00	140.01
	ii) National welfare fund for fishermen	400.00	266.28
	Total*	**9910.00**	**8747.85**

* Exudes outlay and expenditure on Fishery Survey of India and Trawler Development fund, which were transferred to the then Ministry of Food Processing Industries.

Table 46: Profile of plan schemes for fisheries development, eighth plan – 1992-97.

	Scheme	Outlay	Expenditure
1.	Central Institute of Fisheries Nautical Engineering and Training (CIFNET)	1500	1549
2.	Central Institute of Coastal Engineering for Fishery (CICEF)	400	239
3.	Integrated Fishery Project (IFP)	1000	3184*
4.	Fishery Harbour Facility at MAJOR Ports	5400	4583
5.	Fisheries and Training Extension	200	189
6.	Development of Inland Fisheries Statistics	230	212
7.	Central Fisheries Harbour Authority	500	—
8.	Central Project Unit for World Bank 3assisted Project for Shrimp and Fish Culture	770	616
9.	Minor Fishery Harbours	4700	4903
10.	Development of Fresh Water Aquaculture	4200	4381
11.	Integrated Brackish water fish farm development	2500	1193
12.	Development of Coastal Marine Fisheries	6600	4153
13.	Welfare of Fishermen	4200	5887
14.	Assistance for Strengthening Inland Fish Marketing	2500	2033
15.	Enforcement of Marine Regulation Act and Resource Enhancement through Artificial Reefs	3500	2407
16.	Fishnet Making Machine	-	1800
17.	Derelict Water Bodies	-	45
18.	Fishery Survey of India	3600	5258
	Total	**43900**	**42903**

Table 47: Profile of plan schemes for fisheries development, Ninth plan – 1997-2002.

	Scheme	Outlay	Expenditure	
			1997-98	1998-99
1.	Central Institute of Fisheries Nautical Engineering and Training (CIFNET)	2000.00	390.21	298.43
2.	Central Institute of Coastal Engineering for Fishery (CICEF)	300.00	12.29	28.28
3.	Integrated Fishery Project (IFP)	2500.00	405.41	195.97
4.	Fishery survey of India (FSI)	12,400.00	1138.23	1145.23
5.	Fisheries and training extension	1200.00	65.56	40.04
6.	Development of Inland fisheries statistics	900.00	68.65	60.00
7.	Acquisition of dredger with Japanese assistance	3,167.00	—	3165.36
8.	Central Project for World Bank assisted Project for Shrimp and Fish Culture	883.00	97.80	182.29
9.	Fishing Harbours at Major and Minor ports	15000.00	1903.00	1069.30
10.	Development of Fresh Water Aquaculture	15000.00	1494.25	798.00
11.	Integrated Brackish water Fish Farm Development	1500.00	74.07	100.00
12.	Development of Coastal Marine Fisheries	9000.00	1300.91	1063.98
13.	Welfare of Fishermen	10000.00	1506.82	1099.38
14.	Assistance for Strengthening Inland Fish Marketing	450.00	208.32	0.00
15.	Assistance to Coast Guard	200.00	38.00	0.00
16.	Development of Aquaculture in Hill Regions	1500.00	-	-
17.	Development of Inland Capture Fisheries Resources	4000.00	-	-
	Total	**80000.00**	**8703.52**	**924626**

CHAPTER 21

STRATEGIES AND METHODS FOR PROMOTING FISHERIES DEVELOPMENT

Introduction

A fishery provide the fifth largest agricultural resource accounting for 7.5% global food production and is the chief source of food protein for common people besides providing economic livelihood for many. Since independence, India has gradually emerged as a major fish-producing nation in the world being second in total aquaculture production and third in the overall fish production. India with a coast line of over 8143 Kms and Exclusive Economic Zone of around 2.02 million sq. km. Central Marine Fisheries Research Institute 's potential yield estimate is 3.9 million tones from total EEZ of this 1.7 million tones is available from outer continental shelf while the inshore water are being exploited to their full capacity. India is also having vast and varied inland water resource. Both capture and culture fisheries, the potential yield for inland fisheries has been estimated to be 4.5 million tons.

At the present point in time, there is danger of decline in capture fishery production due to overexploitation and habitat degradation. Increased production is possible through aquaculture, which is the world's fastest growing food production sector. But as witnessed in India's shrimp aquaculture, unregulated growth, a disease out breaks and projected adverse environmental degradation has had an adverse impact. However the picture can be considerably improved, if a participatory management process of all stakeholders viz., fishing community, industry, consumers and government is effected which takes advantage of latest technological innovation and production is increased in a sustainable manner without any adverse socio-economic and environmental impact.

Since fisheries is a broad term, the methods and strategies for its development are discussed under six headings such as Resource management, Aquaculture, Environmental issues, Harvest and post-harvest technology, Human Resource Development and Socio-economic issues.

I. Resource Management

The marine fisheries in India have transformed its nature from subsistence level activity to the fishing for commerce towards the turn of 19th century. The commercial orientation was further strengthened during the 20th century. The most rapid development in the marine fisheries sector came during second half of the current century. These developments were mainly directed towards increasing fish production and foreign exchange earnings.

Our marine living resources are spread in the Indian Ocean, Arabian Sea and Bay of Bengal covering an area under EEZ. The Indian Ocean has total area of 51 million sq kms. After declaration of EEZ in 1997, the available for fishing is estimated as 2.02 million sq.kms. Comprising 0.86 million sq.km. On the West coast, 0.56 million sq. km. On East coast and 0.60 million sq.kms. Around Andaman and Nicobar Islands. The present scenario of marine fisheries in the Indian EEZ is that of mixed status with coastal fisheries nearing optimum level of development and deep-sea and oceanic fisheries receiving scant attention. The euphoria of acquiring the vast area on the seas around the peninsula and envisaged development through the exploitation of rich fish stocks within the Indian EEZ could bring in certain deep-sea fishing schemes but they had limited positive impact. Our future effort should be in the line of optimizing the use of potential resources by application of eco-friendly technologies, maximizing use of fish that is caught by these technologies for human

consumption and minimizing post-harvest losses. Preservation of ecological balance through sustainable exploitation of resources and management measures aimed at continuance of stock potential to meet the nutritional demands of ever growing human population.

In the inland sector of India, problems of resource management are not the same as in all other developing countries. A good many problems of India are peculiar and many others are similar to other developing countries. Some of the common problems of developing countries are, dearth of natural resources and suitable technologies, population explosion, poverty, ignorance, orthodoxy, religious taboo etc. India is bestowed with vast and varied type of inland waters as well as indigenous fish fauna. We face problems of diversity of natural resources, topographical and agroclimatical differences, varying types of indigenous fish fauna, vagaries of nature etc. Management policies are needed to be formulated keeping in view their regional nature.

Recommendations

Marine Resources

a) Estimation of exploited marine fisheries resources

As the marine fisheries of India are supported by multispecies and harvested by multi gear all along the coast line during day and night almost the year round, a sound technique for collection of catch and effort data has to be employed for the entire coast.

b) Rlation of fishing effort

Due to open access, Indian marine fisheries, of late, has slipped from labor-intensive artisanal fisheries to capital-intensive industrial fisheries. The major shift from artisanal fisheries due to rapid growth of mechanized fleet in recent years has increased the fishing pressure by overlapping of fishing activities of both the sectors on coastal resources.

It is a fact that many of the most valuable stocks of pelagic and demersal origin are nearing or have reached full exploitation levels. In most fisheries, over fishing signs like reduction in the average size of fish caught and declining catch per unit of effort have been observed. Intensive exploitation if continued further in inshore areas would leak to undesirable economic over fishing and conflicts between the artisan and mechanized sectors. Conservation or inshore fish stocks hence would require managerial measures to avoid commercial depletion of coastal resources.

c) Diversification of fishing

In the inshore areas diversification of fishing activity has to be encouraged to reduce the fishing pressure on the demersal fishes particularly the shrimp resources. For this, target fishing would be the ideal answer and if needed financial assistance may be provided to shrimp trawl owners for diversification.

d) Standardization of effort

In marine fisheries of India, like in any other tropical multispecies fisheries, calculation of the standard effort is needed for suggesting the required effort to be employed for management of fisheries. Standardization of fishing effort in terms of widely used gears for various commercially important species for exploitation on a sustained basis.

e) Maximum sustainable yield

Estimation of MSY may be considered an s important as an upper limit to catch that can be taken from a stock. Changes in the MSY level of fish resources year after year are natural. To fish at changed MSY level, effort has to be reduced correspondingly which can be estimated especially through surplus production models. The challenges for the scientists are to estimate MEY and OSY for all the resources in the next two decades.

f) Deep sea fisheries development

Deep sea fisheries resources of the country has been estimated as 1.4 million tones between 50 and 200 m depth zone and 0.3 million tones beyond 200 m depth in the EEZ. A suitable deep-sea fisheries policy (DSFP) and its effective implementation would be needed to utilize the resources. Whatever threats are visualized in the DSFP, it is necessary to evolve viable solution with long-term vision. While formulating the strategies, the in-put control such as limit on catches have to be given due consideration.

g) Amenable fishing and participatory approach

The difficulties involved in the management of Indian marine fisheries are mainly related to the number and type of user groups and the distribution and mobility of fish stocks. Several conflicts particularly between the subsistence.

In most cases, it is desirable to include the users of the resources and other environment stakeholders on the development and execution of a management plan as co-managers. In the interest of equality and the multiple use of the marine environment, there is a good case for fisheries to be co-operatively managed by representatives from industry and community as well as the government

h) Ercement of conservation measures

For sustainable development and management of fisheries, suitable direct, indirect and technical conservation measures and the effective enforcement of existing regulations are needed. The success of the fisheries management straggles generally depends on the total implementation of one or more of the conservation measures at a time.

The conservation measures should consider imposing ban on monsoon fishing throughout the also on night trawling activities by the bottom, midwater and pelagic trawlers, purse seining and ring seining. A also, to conserve the demersal resources especially the shrimps

i) Managerial skill

The implementation of fisheries management policy by the regulator is a difficult task .the regulator should ensure that the resources user s abide by the legislative and regulatory the fairest extent. For effective management of fisheries resources, the managers require a much wider range of political legal, sociological and above all conflict resolution skill, rather than specialized skills of assessors.

j) Discards

Discarding of marine e biomass is experienced as an acute problem in developed fisheries. Although, wasting the biomass occurs throughout the distribution chain, the losses are most significant at the point of capture due to deliberate dumping of fish at sea. Though, discards are grouped as 'Quota discards', 'by-catch discards' would be most applicable to our country. Because of the switching over from single day to multi-day fishing in most of the areas the 'discards' problem would certainly become acute by the turn of the century. This problem can only be addressed effectively by a significant shift in the behavioral attitude of the fisheries resource users, rather than formulating other strategies to minimize the same.

k) Eogically sustainable development

As the catch per unit of effort is declining in most of the fisheries, management of single species would have little scope in future. Hence, the concept of single species management may require a replacement by the concept of more broad based ecosystem management that supports all the marine species.

As the marine environment is under pressure from many different production and service sectors like commercial fishing, subsistence fishing, recreation fishing, coastal aquaculture, tourism,

water sports, shipping, coastal development and industrial development, the decline in catch rates should be viewed not mainly due to fishing pressure but because of the environment deterioration.

l) Potential fishing zones

There is the urgent need for the effective utilization of the 'Remote Sensing programme' through the 'Marine remote e sensing information' for accurate delineation of potential fishing zones by the user community. This system has facilitated the prediction of fisheries potential and production prospects in the EEZ, and rapid spread of this information to the user community.

m) Regulatory machineries

Regulatory machineries should be strengthened, expanded, properly trained; they should be vested with more power for enforcement of law. Discharging of untreated sewage; industrial effluents should be strictly banned. Heavy penalty should be imposed on the offenders, no culprit should go unpunished.

n) Use of Molecular Techniques

Genetic characterization of populations, which is not in practice in India, should be initiated without delay with the help of dependable genetic tools like karyotyping, electrophoresis and DNA finger printing for assessing the extent of damage already caused to native germplasm and them to evolve the modalities of rehabilitation if required.

Inland Sector

a) All small water bodies (ponds and tanks) should be registered with the state fisheries departments including those seasonal water bodies, which retain water for more than three months and should be brought under culture.

b) Those under multi ownership and where owner is not present, the water body should be given to village panchayat or fish production groups (Saha &Acharya, 1989) for the purpose of aquaculture.

c) Keeping any productive water body fallow should be treated as offence.

d) Inputs should be supplied by the Govt. or Govt. authorized agency at fixed rates.

e) Technologies suitable under local conditions should be extended to the fish farmers by the Fisheries Department.

f) State Fisheries Department may get the work done through agencies like FFDA, Apex fisheries co-operative Society or Fisheries Corporation etc. under their supervision.

g) Mobile dispensary, fold chain are also to be organized for overall development of inland fisheries.

h) Reservoir areas to be let out to fisheries co-operatives for regulated exploitation, and poaching control only. Stocking, stock manipulation, development of productivity and marketing of produce will be in the hand of the State Govt. Economic interests of the fishermen in respect of their produce should be protected.

i) Development of weed-infested beels is a problem of high magnitude. It may not be possible to take up entire area for development at a time. Work may be taken up by State Department in phases.

j) Intensive cage culture of air-breathing fishes at the fringes of beel waters will serve as a source of extra income to the unemployed family members of local villages as well as increases fish production.

k) Juveniles of both fish and prawn can be collected and reared in ponds or used for river ranching as is now being done in West Bengal. This activity should be taken up as a regular function of all State Fisheries Departments having reverie fisheries resources.

l) Rapid survey of reservoirs/lakes in different agro-climatic conditions of the country is required to classify them based on their ecology and formulates management measures for each group through detailed experimentation.

m) There are conflicting interests of various users of inland waters. Common property nature of resource with open access creates problem for management. In case of rivers flowing through more than one state, the exploitation policies are at variance with none caring for conservation or development of fisheries. Perhaps, creation of an inter-state Riverine Fisheries Board should be considered for formulation of a rational and ecological sound development and exploitation policy for fisheries of such rivers. Stringent control measures have to be exercised on the use of water resource by industry and other users.

n) Fisheries being a state subject under the constitution, Central Government has very limited control as rules and by-laws are framed by State Governments under enabling powers as incorporated in Section 3 of Indian Fisheries Act, 1897. This Act was promulgated at a time when there was negligible environmental degradation and considerations. This Act needs be revised and efforts made for strict enforcement of legal provisions.

Aquaculture

World aquaculture dates back to china from the 5th century, its development has been confined to a few regions and at present there are about 190 sp. Known to be cultivated of which more than 10 acre being cultured in southeast Asia. The Asian region has been and still is the center of aquaculture production and diversity. Aquaculture in India has witnessed remarkable progress particularly during the post independence period. Apart from substantial contribution to the national economy it has emerged as a lucrative venture of growing industry. Over the years the country has made great strides not in increasing the total aquaculture production but also enhancing the unit productivity from a subsistence level to mean national productivity of about 2 t/ha/yr through adoption of scientific culture technologies. The production has shown a quantum leap from 0.51 million tones in 1984 to 1.63 million tones in 1994 registering 215% increase during the period. However, bulk of the production is contributed by a few species of carps. Though aquaculture in India is carp-based and carps contribute, as much as 89% of the total aquaculture production at present, the country possesses vast potential in terms of other species resources for diversification.

The catches from the rivers have dwindled considerably and several stretches, once the favorite haunts of the fish and fishermen alike, are now depleted of those rich stocks, which they once harbored. While increased fishing pressure is the root cause of this decline, it has largely been compounded by dam construction, water abstraction, domestic and industrial as well as pesticide and herbicide pollution.

The estuaries are a function of the rivers and the impact of the changes upstream is reflected in the ecological disturbances in the estuaries. As such, the major estuaries and lagoons also have not been spared by pollution, siltation and vegetation. The Hooghly estuary, Chilka Lake, and Cochin backwaters have their own tales of woe and have fallen in disgrace with Nature.

Unfortunately, reservoir fisheries development has not been given any serious attention despite the recommendations of the All India Coordinated Research Project on the Ecology and Fisheries of Freshwater Reservoirs to treat them as specific entities. A rule of thumb is applied to all reservoirs with no attention to such details as stocking density/ha, size of fingerlings to be stocked, species-mix, time/period of stocking etc. besides place of stocking or any preparation prior to stocking.

Never before had the world seen such a fast rate of growth as in brackish water aquaculture. More than finfish, it was the crustaceans, which despite there low production and comparatively poor knowledge about their biology and techniques of culture. Shrimp farming which was mainly

a traditional activity grew into a commercial enterprise practiced not only by small and marginal farmers but also by the corporate sector.

Recommendations

Freshwater Aquaculture

I) Assessment of aquatic resources available for aquaculture

Figures relating to the extent of freshwater resources available for aquaculture and culture based capture fisheries in the country do exist, (2.25 million ha of ponds and tanks, 1.3million ha of beels and derelict waters, 2,09 million ha of lakes and reservoirs as also 0.12 million Km of irrigation canals and channels and 2.3 million ha of paddy fields, a portion of which is available for fish culture) but they appear to be not quite reliable. A realistic assessment should be categorized in relation to size, nature (short-seasonal, long-seasonal or perennial) and productivity of the water bodies, to facilitate adoption of different types and levels of technology in different categories of water bodies and to make realistic production estimates, which would enable meaningful aquaculture planning. Remote sensing could possibly be made use of for assessing our aquatic resources.

II) Diversification of production systems

There was hardly any diversification in the initial phase, with polyculture of carps in ponds dominating the freshwater aquaculture scenario. The need for diversified production systems to suit different types of water resources is now fully realized, and several new production systems have been initiated. While some of the earlier production systems have more or less been standardized, much remains to be done regarding the newer systems.

The major production systems presently in vogue in Indian freshwater aquaculture are detailed below

a) Carp culture in ponds

Car culture in ponds has been the most successful and widespread production systems in Indian freshwater aquaculture. National mean productivity is 2 t/ha/yr. Where as CIFA shown that 10 15 t/ha/yr. can be achieved under intensive culture system. There is an urgent need to bring this to field condition.

b) Cage culture and pen culture

Cag culture and pen culture production systems in freshwater aquaculture are only is an experimental stage at present; even though there is ample scope for the same. Development of indigenous standardized technologies in this regard should receive priority attention.

c) Waste water culture

The technologies already developed by CIFA in respect of sewage-fed aquaculture and biogas slurry-fed aquaculture need to be further refined and popularized all over the country, with necessary modifications to suit local conditions.

d) Integrated fish farming

This system also provides for recycling of organic wastes. The CIFA has already developed certain technologies for duck-cum-fish culture, poultry-cum-fish culture and agri-/hortasuarinas animal husbandry-cum-fish culture. However, these require to be further refined to make them applicable to different regions of the country, taking into consideration the organic load in the pond effluent of such systems.

e) Raceway cultures and culture in recirculatory system

The two production systems, which have high yield potential, are yet to be seriously tackled in the country. It would be worthwhile to develop standardized indigenous technologies for these sophisticated systems for adoption by entrepreneurs.

f) Culture systems for seasonal water bodies

Indan has innumerable small seasonal water bodies, which retain water for 5-8 months only. Suitable technologies are required to be developed for gainful utilization of these waters for monoculture of all-male tilapia, stunted Indian major carps and Chinese carps, sterile common carp and freshwater prawns.

III) Diversification of cultivable species

The culture of Indian major carps and some exotic carps still dominates the freshwater aquaculture sector to a significant extent. However, there are a number of other economically important species, which could be gainfully brought into the aquaculture fold. Some of them have already been taken up in recent years, but are mostly still in the initial phase of technology development. The more important ones are briefly detailed below.

a) Medium sized carps

A number of medium sexed carps, like *Labeo fimbriatus, Cirrhinus cirrhosa, Puntius kolus, P. pulchellus,* etc. are economically important and, therefore, deserve to be considered for monoculture or polyculture with major carps, catfishes or freshwater prawns. There fore, it is imperative to take up studies to evolve suitable technologies for their commercial seed production and culture practices and to promote their culture in regions where they command good consumer preference.

b) Food fishes

Even though the Mahseers, *Tor khudree,* is a slow grower in ponds; it appears to thrive well in small reservoirs. Therefore, the technologies already available for its breeding and culture should be refined further for commercial application, so that its seedlings could be introduced into small reservoirs for improving their culture based capture fisheries.

Catfishes, both air breathing (magur and singhi) and non-air-breathing (*Wallago attu, Mystus seenghala, M.aor, Pangsius pangasius and Ompok* (spp.) are in great demand in the northern parts of the country. There is as yet no organized culture of magur (*Clarius batracus*), the most important Indian catfish, in the absence of a dependable technology package for its culture. The work done under the All India Coordinated Research Project and subsequently by CIFA in this regard should be taken to its logical conclusion. Similar technology packages in respect of all other commercially important catfishes should also be evolved on a priority basis.

Murrels too have good consumer demand in certain parts of the country, but as yet there is no organized murrel culture system in the country. The existing seed production and culture technologies of Murrels should be further refined and passed onto farmers.

The Indian shad, hilsa (*Hilsa ilisha)*, was successfully bred and the resultant hatchlings reared upto two years at Allahabad in the sixties, but no further progress appears to have been made in standardizing the technology for its artificial propagation. In view of the very high consumer demand for this fish and the dwindling of its stock in various rivers, it is urgently necessary to evolve standardized technologies for commercial scale seed production and culture of hilsa, in order to be able to restock the depleted rivers and to meet consumer demand.

c) Ornamental fishes

Apart from fairly good local demand, ornamental fishes have very high export demand. It is, therefore, necessary for R and D agencies to standardize the technologies for their mass production.

d) Freshwater prawns

Even though the two most commercially important freshwater prawns (*Macrobrachium rosenbergii* and *M. malcolmsonii)* have good demand both within and outside the country, their breeding and farming have received serious attention only recently. Hatchery technology has lready been worked out for both the species; but while several commercial scale hatcheries have come up in the public and private sectors for *M.rosenbergii,* commercial scale hatchery for *M. malcolmsonii* is practically non-existent. In view of the tremendous scope for their culture in India, it is urgently necessary to evolve viable package of practices for their sustainable culture.

e) Freshwater pearl culture

It is reported that some entrepreneurs have already started freshwater pearl culture on a commercial scale. It is now necessary to standardize the technologies for commercial scale mussel hatcheries and culture systems, development of better nuclear material, commercial production of cultured pearls and post-harvest up gradation of pearls.

IV) Survival

At present, the survival of fish seed from spawn to fingerling stage is generally less than 25%; Efforts must be made on a priority basis to increase the survival rate to at least 50%, which would mean substantial saving in the cost of seed.

Coastal Aquaculture

I) Assessment of coastal areas suitable for brackishwater aquaculture

The presently available figure of 1.19 million ha requires updating with the help of remote sensing data and G.I.S. information. A reliable assessment of the brackishwater aquaculture resources in relation to size, nature and suitability for different types of production systems would enable the authorities to make meaningful brackishwater aquaculture planning and realistic production estimates.

II) Production systems and cultivable species

Scientific coastal aquaculture is a relatively recent activity in India. In earlier years, brackishwater aquaculture was confined to tide-fed and auto-stocked coastal low-lying areas in West Bengal and Kerala, while mariculture was practically non-existent. The long stagnation in world fish production from the late sixties to mid-seventies, due mainly to stagnation in marine capture fisheries, gave a fillip to the growth of coastal aquaculture in the world, including India. The progressively increasing demand for shrimps in the international market resulted finally in the establishment of innumerable shrimp farms by the private sector in India's maritime states in the eighties, mainly along the east coast. The government sector too became active during this period and established several hatcheries and R and D centers for coastal aquaculture of finishes, crustaceans, mollasuarin seaweed's.

Brief details of various production systems and species cultivated are given below

a) Traditional coastal aquaculture ("Trapping and holding system")

This was initially practiced only in West Bengal and Kerala, but it later spread to Karnataka, Goa and Orissa. I n the initial phase of this system, there was no external inputs (seed, feed and fertilizers) at all. Later on, some farmers started resorting to periodic stocking of shrimp and fish seed to increase stocking density, while some even resorted to pond preparation and use of fertilizers. The average yield in this system varies from 350-1000 Kg/ha/season in different states. It is desirable to bring all these traditional culture impoundments under the improved extensive culture method.

b) Shrimp culture

In view of the high economic value of shrimps, it is necessary; to continue and expand the culture of the presently cultivated species and to bring in all other commercially important species after standardizing their hatchery and culture technologies. It is highly imperative to refine the existing technologies relating to *P. monodon* and *P. indicus* in order to arrive at sustainable production technologies for various levels of culture.

c) Other crustaceans

Crabs and lobsters have good export potential, of the five candidates species of crabs only *Scylla serrata* and *S. tranquebarica* are presently receiving some attention. Crabs can be included in polyculture with milkfish and mullets. As yet, no viable hatchery and culture technologies have been evolved for crabs and lobsters in India with the result they are yet to be taken up for commercial culture. This, therefore, requires urgent consideration.

d) Finfish culture

There is no commercial marine finfish cu8lture in India so far, although a number of candidate species are now receiving attention for their hatchery production and culture. Among them may be mentioned the grey mullets (*Mugil cephalus* and *Liza macrolepis*), Indian sand whiting (*Sillago sihama*), milkfish (*Chanos chanos*), rock-cod (*Epinephelus* spp), pearl-spot (*Etroplus suratensis*) and seabass (*Lates calcarifer*).

All these have been only on experimental lines and viable technologies are yet to be evolved. It is needed to attempt their culture in ponds, pens and cages.

e) Molluscs

A package of practices for cultured pearl production has been standardized. The species of pearl oyster presently cultured is Pinctada fucata, which is culture on rafts. A technology for production of colored pearls also has been developed. Commercial production of pearls based on technology developed started in 1983. Attempts should now be made to develop hatchery technologies for two other pearl oysters, *P.margaritifera* and *P. maxima.*

Culture of the edible oyster *Crassostresa madrasensis* through the rack and tray method, ren method and stake method has been successfully developed and the technology demonstrated through a pilot project. Packages of practices have also been evolved for the culture of green mussel and brown mussel (rope culture and long line culture) and five species of clams. On-shore culture of pearl oyster, edible oyster, clams and mussels has been planned for the early part of the next century. The proposed abalone culture is worth attempting.

f) Sea cucumber

The CMFRI has been successful in breeding sea cucumber under captivity and in raising a limited number of seed. It also attempted ranching of the sea with the few seed

raised. However, it is to be stated that ranching would be meaningful only when it becomes possible to release adequate number of weed, for which purpose commercial scale seed production would be required through development of viable breeding and hatchery technologies.

g) Seaweeds

Culture of seaweeds in open waters was undertaken successfully and its feasibility demonstrated at a couple of locations. Many types of seaweed are good sources of phytochemicals, while some are edible. There is ample scope to expand seaweed culture in a big way.

General Considerations

Some major measures to be taken on priority basis in relation to some important parameters that are common to both freshwater and coastal aquaculture are listed below;

I) Pond Management

a) To develop suitable guidelines for judicious application of inorganic and organic fertilizers to avoid pollution effect.

b) To encourage the use of bio-fertilizers like Azolla and to screen more such plants to ascertain their utility as bio-fertilizers.

c) To refine and standardize the existing weed control measures, while giving priority to biological control.

d) To elucidate the acceptable levels of pesticide residues in cultured finfishes and shellfishes and to determine the biological half-life of pesticides commonly used.

e) To use aquatic weeds to absorb nutrients and pollutants from the wastewater in waste water aquaculture.

f) Evolving on-farm water management strategy in ground water fed farms when water supply decreased, possibly involving treatment and re-use.

II Physiology, Breeding And Genetics

a) Identification and synthesis of cheaper and more effective induce agents than those presently in use.

b) Standardization of multiple spawning and off-season breeding technologies, as also techniques for improving gonadal maturation and egg quality through hormone treatment and feed manipulation.

c) Standardization of techniques for sex reversal through hormonal treatment or hybridization to produce monosex or sterile individuals.

d) To raise new varieties and inter-specific/inter-generic hybrids with superior culture qualities through selective breeding and hybridization respectively and their appraisal.

e) Standardization of chromosomal manipulation techniques, like gynogenesis, androgene4sis and polyploidy, for developing genetically improved strains.

f) Commercial production of sterile triploid grass carp for stocking in reservoirs and irrigation canals.

h) Study of digestive physiology of commercially important finfishes and shellfishes in order to be able to develop balanced cost-effective diets.

g) Production of transgenic finfishes and shellfishes.

h) To improve the existing technology for cryopreservartion of milt and development of a suitable technique for cryopreservation of eggs, for ensuring seed availability throughout the year.

II) Nutrition

a) Determination of nutritional requirements of various stages of presently cultivated finfishes and shellfishes and of candidate species for culture other than of those already studied.

b) Development of suitable diets on the basis of findings of the study on nutritional requirements as suggested above.

c) Determination of dietary vitamin and mineral requirements for improving gonadal maturation.

d) Development of least-cost diets through fishmeal substitution by unconventional feed sources.

e) Determination of merits of various non-hormonal growth promoters.

f) Development of technology and promotion of commercial scale production of single cell protein (e.g. Spirulina).

g) Incorporation of 'probiotics' in fish feeds for deriving better-feed conversion and growth.

III) Pathology

a) To evolve effective curative and prophylactic measures on a war footing to ackle-devastating diseases like "EUS' among fishes and white spot disease among shrimps.

b) Standardization of rapid immuno-diagnostic methods for bacterial, viral and fungal diseases of finfishes and shellfishes.

c) Development of an immuno-diagnostic kit that could be easily used by farmers.

d) Development of vaccines against important parasitic, bacterial and fungal diseases of finfishes.

e) Elucidation of effect of immuno-stimulants on resistance to diseases in fishes and shellfishes.

f) Development of fish and prawn cell lines for disease control investigations.

g) Studies in inducing immunity in fishes through the use of 'probiotics which are generically engineered to produce antibodies against harmful bacteria, instead of using the costlier commercial immuno-stimulants.

h) Development of proper certification and quarantine systems and establishment of a network of quarantine centers throughout India in respect of import and export of finfish and shellfish.

i) Development of a disease reporting information system to meet WTO and GATT protocols

IV) Aquaculture Engineering

a) Standardization of parameters for aquaculture site selection.

b) Standardization of designs of infrastructures required for various aquaculture production systems (ponds, cages, raceways, recirculatory systems, pens, racks, hatcheries, waste treatment plant, etc.)

c) Standardization of equipment's and accessories used in aquaculture (aerators, biofilters, automatic feeders, mechanical harvesting and handling systems, etc.)

d) Study of relation of pond design (shape, depth, dimensions, etc.) to fish production.

V) Aquaculture Economics

a) Economic evaluation of each aquaculture production system to identify economically viable systems.

b) Economic evaluation of aquaculture inputs, such as seed, feed, fertilizers, etc.

c) Study of socio-economic impact of aquaculture.

Environmental Issues

Its true that man is an integral part of nature, the dividing line between man and nature is due to the all-pervasive ego. Unless the ego is dissolved and reconciled with the fundamentals of nature, the conflict between man and nature will continue. The ego manipulates itself in the form of technology, innovations, desire to accumulates desire to exploit selfishness and greed. Only if the ego is dissolved can man function to enable the evolution of a technology, which is humane and will work towards catering of needs and not the fulfillment of greed.

Recommendations

a) Standardization of procedure for environmental impact assessment (EIA)
b) Carrying out appropriate EIA on mandatory basis before embarking on large aquaculture projects.
c) Standardization of techniques to prevent environmental degradation through effective treatment and management of the farm effluent.
d) With regard to the existing Supreme Court order relating to aquaculture activity within the CRZ and pending the passing of government's proposed aquaculture bill by parliament, it is suggested that instead of demolishing the existing semi-intensive and intensive farms located within 500 meters of the CRZ, they may be converted in to improved traditional type, which is permitted by the Supreme Court, and their productivity increased through controlled fertilization and artificial feeding, with appropriate effluent treatment.
e) Give emphasis of proper environmental impact assessment at the project stage itself.
f) Maintain specified distance between farm units, between nearest freshwater canal and an aquaculture unit and also from the nearest drinking water sources.
g) Do not overstock the ponds
h) Have separate water supply and drainage systems.
i) Use organic manure and fertilizers at optimal doses.
j) Do not discharge the wastewater into the open environment or drainage canal without proper treatment.
k) Resort to aeration and daily water exchange for maintaining good water quality and for reducing organic load.
l) Incorporate Environment Monitoring Plan and Environment Management Plan in all projects above 20 ha area.
m) Identify zones of suitable and unsuitable areas using remote sensing data, Geographic Information System etc., and prepare Master plan for development.
n) Destruction of mangrove areas and ecologically sensitive wetlands and conversion of agricultural and other productive lands should not be permitted.

Harvest And Post Harvest Technology

World catch of fish has increased in the 1970's and 1980's but seems to have stabilized since 1988 to just around 100 million tones. As the human population is ever increasing, the tendency for demand to exceed supply is also increasing, resulting in widening supply/demand gap. This has the inevitable consequences of reduced availability, rising price and a search for alternative resources to close the gap. Limited availability will be particularly severely felt by people in developing countries to whom fish is often the most important source of animal proteins as well as a culturally acceptable food. Action will be required on a variety of fronts and better integration of all the scientific, technical and economic disciplines will be necessary. The post harbest6 technologist will have to play a more prominent role in this team.

Recommendations

a) Fishing gear selectivity

It should be ensured that fishing gear, methods and practices, to the extent practicable are sufficiently selective so as to minimize waste discards, catch of non-target species, both fish and non-fish species and impact on associated or dependent species and that the intent of related regulations is not circumvented by technical devices. Information on new developments and requirements is made available to all fishes and in turn fishers must co-operate in using them.

In order to improve selectivity, while drawing up laws and regulations, the range of selective fishing gear, methods etc. available to the industry must be taken into account.

Select and relevant institutions should collaborate in developing standard methodologies for research into fishing gear selectivity, fishing methods and strategies. International co-operation should be encouraged with respect to research programs for fishing gear selectivity, fishing methods and strategies.

b) Need for environmentally friendly fishing techniques

There is a growing concern with regard to the impact of heavy ground gear like bottom trawl on the morphology of the substrate and the damage it causes to the sponges, coral beds and other benthos. Gear trials and evaluation of semi-pelagic trawl systems indicated supremacy over the conventional demersal trawling systems. In the semi-pelagic trawl system where the footrope is at a height above the seabed and fork type rigging, there is less environmental degradation of the seabed (Mousey, et.al. 1997)

c) Responsible fishing to be complimented with responsible trade

There is a urgent need to check and have control measures to avoid sale of juveniles and also regarding the present fishing overcapacity and absence of adequate controls which may endanger future fisheries resources and economic benefits.

"Fish that should not be caught should not be traded" (Anon, 1997).

d) Energy optimization

States should promote the development of appropriate standards and guidelines, which would lead to the more efficient use of energy in harvesting and post harvest activities within the fisheries sector.

States should promote the development and transfer of technology in relation to energy optimization within the fisheries sector and in particular, encourage owners, charterers and managers of fishing vessels to fit energy optimization devices to their vessels.

Fuel-efficient fishing methods- like lobster trap provided with an escape gap as conservation measures (Developed by CIFT) and Gill net. By these gears we can able to avoid the overexploitation. So its need of the time to develop these kind of gears.

e) Harbors and landing places for fishing vessels

An institutional framework must be established for the selection or improvement of sites for harbors for fishing vessels, which allows for consultation among the authorities responsible for coastal area management.While designing and constructing harbors the following points have to be kept in mind

1) Adequate servicing facilities for vessels.
2) Adequate freshwater supplies and sanitation arrangements.
3) Waste disposal systems should be introduced including disposal of oil, oily water and fishing gear.
4) Pollution from fisheries activities and external sources should be minimized.
5) Arrangements should be made to combat the effects of erosion and siltation.

f) Artificial reefs and fish aggregation devices

States should develop policies for increasing stock population and enhancing fishing opportunities through the use of artificial structures, placed with due regard to the safety of navigation on or above the seabed or at the surface. Research on the use of such structures and its impact on living marine resources and the environment should be promoted.

g) Suggestions for implementation of responsible fishing

1) Information on new developments in fishing technology and requirements of responsible fishing must be made available to the fishermen and their involvement encouraged in the decision-making process and implementation of the code of conduct.
2) Environmentally friendly fishing techniques must be encouraged.
3) Fuel saving fishing methods like gill netting and trap fishing to be adopted on a larger scale.
4) Need for co-ordination of all relevant government agencies in order to ensure that policies and actions are not countered productive. Support to agencies helping in reallocating excess fishermen by providing training for new skills and initiating special land schemes for fishermen.
5) Artificial reefs and fish aggregation devices should be developed on a larger scale.
6) Development of infrastructure like landing places and fishing harbors with due regard to waste disposal system and pollution control.
7) Employment of fishing techniques like line fishing and gill netting to reduce by catch to minimum. Similarly square mesh in a trawl and exclusion devices reduce the by-catch of non-target and immature fish.
8) Ban on export of undersized fish.

Human Resource Development

After independence, India has achieved significant progress in preparing trained R and D personnel through the infrastructure built in the form of universities under the UGC and the central institutes, fisheries colleges in various states and under the ICAR and CSIR. There personnel possessing postgraduate degree in general and doctorate and pot doctorate research degrees in particular have shown themselves as a potentially useful band o researchers bringing the fisheries research on par with world class R and D elsewhere. The institutions having overlapping objectives and limited financial support are not able to optimally utilize the human resource potential, this is where we need very serious thought as to how to put these personnel in the right places with the institutions having well defined non-overlapping objectives.

It can be stated that, a certain level of manpower available with the various fisheries institutions in the for of scientists, technologists, researchers, administrative personnel and other supporting staff are working on the similar aspects or programs but in different organizations. If these institutes are recognized with well defined specific objectives, the human resources spread over in many institutions would be really redeployed to achieve more and high degree of excellence with the same resource and simultaneously the duplication in the work as well as the manpower problem will be reduced to a great extent.

On the other hand, the recent setback caused in coastal aquaculture due to disease

Outbreak has proven beyond doubt the poor entrepreneurial acumen of the workforce involved in fisheries activities of our country. Likewise, inspite of having demonstrated the possibilities of taking production to the tune of over 17,000 Kg/ha/yr. The low average yield of

2,180 Kg/ha/yr. presently obtained from FFDA ponds speaks of serious lapses on the part of managerial skill of the involved manpower in aquacultural pursuits of the country. Scenarios relating to the management of other fisheries resources are also not much different. All these suggest that our country now needs more of well-trained resource managers rather than resource explorers or exploiters.

Recommendations

I) Development of professional competency

a. Managerial effectiveness

Basically the job of a manager is to direct the activities and the people under him to reach pre-determined objectives with the optimum use of resources available to him. The job of a manager can be looked upon as a process involving five basic steps, namely,

1) Planning It is connected with achieving the desired goals.
2) Organizing It's aimed at integrating the available factors into an optimum relationship with a view to effectuate plan.
3) Staffing It seeks to select and develop the performance or manpower.
4) Motivating It aims at inspiring and inducing the people within the organizing to direct their efforts towards the implementation of the plan.
5) Controlling it takes care of evaluating the performance of manpower periodically and attempts to ensure that the activities are actually executed in consonance with the plan.

b. Leadership

Leadership can be defined as an activity of influencing people to strive willingly for group objectives. The sources of a leader's powers and influence include the following

1) Reward power i.e. the power to compensate or give rewards for tasks successfully accomplished.
2) Coercive power i.e. the power to punish.
3) Legitimate power i.e. the power of lawful or formal authority.
4) Referent power i.e. the power to cause others to imitate one's personal style or behavior.
5) Expert power i.e. the power of superior knowledge, ability or skill.

c. Motivation

Motivation can be defined as a willingness to expend energy to achieve a goal or reward. It is a force that activates dormant energies and sets in motion the action of the people. It is the function that kindles a burning passion for action among the workforce of an organization. The purpose of the motivation, therefore, is to create conditions in which people are willing to work with zeal, initiative, interest and enthusiasm, with a high personal and group moral satisfaction, and with pride and confidence in most cohesive manner so that the goals of and organization are achieved effectively.

d. Communication

Communication is one of the most basic functions of management. The manager can make a good decision, think out well conceived plans, establish a sound organization structure and be well linked with his associates .The manager cannot get the work done through his subordinates unless he is sure of some basic facts i.e. what he wants to be done? How it is to be communicated and what results are expected from the communication. It is, therefore, very necessary for the management to have a properly developed communication system.

Communication can be defined as "the process of passing information and understanding from one person to another. It is essentially a bridge of meaning between people". The importance of communication in any managerial process can hardly be over-emphasized. If an organization is to operate a an integrated unit, it is necessary that the top management should keep the lowest level supervisors and employees well informed of its ultimate objective and what it wants each person to accomplish towards their realization. By freely sharing information, the management takes employees in confidence, prepares them for desirable changes, avoids misunderstanding and makes them more knowledgeable about the problems and policies of the enterprise.

II) Improvement of fisheries education

a) Uniformity in fisheries education

At present, the CIFE, Fisheries colleges and Agricultural Universities are imparting the degree and post-graduate fisheries education in different states. The courses and curriculum are made as per their suitability and convenience. There is a gap in proper knowledge, know-how, technological innovations and their implementation in the country. There is a severe need to run the courses on similar or uniform basis at national level to avoid duplication.

b) Advancement in the teaching

The teaching methods adopted should be made available to all with modern audio-visual systems at national level like preparation of slides, audio and video cassettes etc. The teacher should be appraised with the latest technologies and its implementation through establishing a National Center for Human Resource Development.

c) Revision of syllabus

In fisheries, the major courses covered include capture fisheries, culture fisheries, processing, harvesting etc. The syllabi are more or less similar at various levels. There is an immediate need to revise the syllabi at national level for the improvement of the quality of the education system. Syllabus prescribed should be a model for students and need based.

d) Uniform system of admission

At national level, various universities are conducting examinations throughout the year. This creates lot of inconvenience for the planners and administrators. A uniform system of admission if adopted by all agricultural college/universities will help the nation for future planning and conducting admission tests.

e) Development of laboratories and aqua-farms

There is an immediate need to establish model laboratories in different states in different disciplines for better scientific and research environment so that the recent developments should be used for better manpower training.

f) Manpower planning and management

To educate and develop the manpower, a proper planning is very much essential. In education system, there is an urgent need to plan the courses in fisheries based on self-generation of funds in future. Besides, educational planning should be in such a manner at national level that it should be able to improve the status of the industry, rural and tribal mass through the schemes for various upliftment purposes.

g) Concept of fishery estate

This is a very important aspect for fishery. A good number of manpower's are required for fisheries development. But due to lack of infrastructure in the rural areas an educated youth does

not want to serve the rural mall. As a result, the ultimate aim of education the people is not achieved. I f the fish farm, tribal area and rural areas have the basic infrastructure like good school, hospital, road, market and other useful facilities, than our lab to land concept can be transferred to the beneficiaries and will be meaningful.

h) Incentive to teachers, trainers and managers

A fishery is such a field, which calls for day and night working. Whether the person is a teacher, trainer or manager, they have to work in the field, on-farm training etc in rural areas, for which some incentive is must to encourage people to work in remote areas, which is lacking at present.

i) Linkages between central and state departments

For better and proper utilization of technologies need-based research, training and extension programs are essential. There should be a central body to initiate the requirements time to time on regular basis with proper monitoring.

Socio-Economic Issues

The second most populous country, India accounts for 16% of the world population with just 2.42 % total world area. This indicates the strain on our natural resources and the importance of judicious utilization of these resources to the optimum level for the benefit and well being of our expanding population

Recommendations

I) The importance should be given towards the creation of infrastructure and its development in the fisheries sector. The infrastructure gaps hindering the progress of speedy development sector for out weighs the achievement. It should be covered either under central schemes or centrally sponsored schemes. The main activities include like, Setting up of fishing harbors/ports.

a) Inland fish marketing.
b) Preservation of fish and setting up of fish hatcheries.

II) Government intervention is required in farming for the guidelines for use of natural resources, polices related to the social development, for example, land tenure, education, health care, provision of alternate employment etc. and integrated resource management.

III)Fishermen need to be thoroughly educated on priority to receive thorough insight in their occupation/profession on scientific basis.

IV) The members of the fishermen community need to be given admission in the fisheries degree and post graduate degree, vocational courses on a quota basis.

V) Fisheries cooperative societies need to be strengthened and streamlined. Fishery cooperatives have to reorient and readopt their structural functioning and management. Action plan in the areas of better functions of fishery cooperatives will therefore be focused on under mentioned aspects Professionalism and efficiency through management.

a) Introduction of modern technology.
b) Strengthening financial resource base.
c) Mobilization of resource.
d) Providing fishery requisites, marketing and storage facilities, basic infrastructure, diesel, ice, freezing and processing plants, transport facilities, maintenance workshops, credit facilities etc.
e) People's participation.
f) Overall development of fisher folk.

VI) 'Extension' should be strengthening in fisheries because it maintains a continuous contact between research institutes on one hand and the development departments, industries, farmers, students and weaker section.

VII) Fisheries Extension needs

a) Knowledgeable Extension officer who is fully alert.

b) Extension centers have to be equipped with latest communication aids comprising different audio-visual equipment's like TV, VCR, still and video Cameras, Computers, Channel network, Tape recorder, sidle and over head projector, STD, fax, Xerox, working and most advanced printing technology.

c) Training and exhibitions have to be conducted for improving and informing farmers.

VIII) Computers now a day have become essential in every walk of life and the field of fisheries stands no exception to it. Internet, Remote sensing and Geographical Information System (GIS) are classic example of converting this potential into a reality.

Conclusion

It is time to recall that India was one of the pioneers amongst developing countries to list its biota, especially aquatic fauna back in the last century and develop its cadastral maps by survey of India. Indian advancements in the field of fisheries were foremost in Southeast Asia till the fifties. When Indians were experimenting carp and shrimp culture and demonstrating results, only China was at the same level, while, Indonesia, Thailand, Philippines, Taiwan were busy denuding their mangroves for milk fish culture. Today these countries have raced much ahead, albeit with sad experiences of catastrophes of pollutional collapse of shrimp culture due to lack of monitoring of pond environment and knowledge to deal with diseases. Ironically, India having known about the first to motorize their fishing crafts, but Thailand, Taiwan, Singapore advanced fast and fish in international water all aver South-east Asia, while we are unable to tap our own EEZ beyond 50 m depth. The lost ground has to be regained and India has to regain her glory. For this several challenges are to be taken by the horn, for which politician, bureaucrats, economists, planners and fisheries experts have to come together.

The globalization of technologies and free trade is a reality and would only get strengthened as we walk into 21st century. So would be the need to protect environment and ensure sustainability of the productive resource base. The conflict would lead to more restricted availability of quality land and water for aquaculture and cut throat competition from abroad for market share facing sea fisheries. These challenges will have to be met by not multiplying institutions but by strengthening and consolidating the available resources and the vast pool of scientific expertise across the country. Developmental authorities and decision makers at the National Planning level would need to give a hard look at the requirements of change at the legal and regulatory frame and assess investment needs and bring equity amongst alternative food production system, preferably by increasingly integrating aqua foods with land based foods and removing bottlenecks facing the enterprising Indian capability in fisheries and aquaculture.

Part - VIII

Commercially Viable Model Fisheries Projects

CHAPTER 22

MODEL PROJECT FOR BRACKISH WATER SHRIMP FARMING IN COASTAL DISTRICTS

Introduction

India is endowed with a long coastline and hence offers scope for large exploitation of marine wealth. Till a few years back, fishermen in India were involving themselves in traditional marine fishing. In the seventies fishermen started concentrating on catching prawns more commonly known as 'shrimps' due to high profitable return on the same on account of their export value. Brackish water prawn farming started in a big way during 91-94 especially in the coastal districts of Andhra Pradesh and Tamil Nadu. Subsequently due to disease problems, litigation in supreme court and other social and environmental problems the sector suffered a huge set back and most of the corporate farms were closed. However, the small units continued to do farming and adopting extensive prawn farming systems. The shrimp farming has now been regulated with the establishment of Aquaculture Authority of India as per directions of Supreme Court for issuing licenses and overall supervision. It is commonly said that after Green and White Revolution in India, it is time for Blue Revolution to exploit the huge potential in fisheries sector. Shrimps are called the "Pinkish Gold" of the sea because of its universal appeal, unique taste, high unit value and increasing demand in the world market.

2. Sea for brackish water shrimp farming

The over exploitation of shrimp from natural sources and the ever increasing demand for shrimp and shrimp products in the world market has resulted in the wide gap between the demand and supply shrimp in the International market. This has necessitated the need for exploring new avenues for increasing prawn production. The estimated brackish water area suitable for undertaking shrimp cultivation in India is around 11.91 lakhs ha. spread over 10 states and union territories viz... Ist Bengal, Orissa, Andhra Pradesh, Tamil Nadu, Pondicherry, Kerala, Karnataka, Goa, Maharashtra and Gujarat. Of this only around 1.2 lakhs ha. are under shrimp farming now and hence lot of scope exists for entrepreneurs to venture into this field of activity. The following table gives the state-wise potential and present level of development as on March 1996.

Table 48: Resource profile of brackishwater area.

Sr.	State	Estimated brackish water area (ha.)	Area under cultivation (ha.)
1	West Bengal	405,000	34,660
2	Orissa	31,600	11,000
3	Andhra Pradesh	150,000	50,000
4	Tamil Nadu	56,000	2,879
5	Pondicherry	800	37
6	Kerala	65,000	14,657
7	Karnataka	8,000	3,500
8	Goa	18,500	650
9	Maharashtra	80,000	716
10	Gujarat	376,000	884
		1,190,000	118,983

3. Location of the project

The first and foremost requirement for entering into this venture is the acquisition of suitable land. The details of land identified/surveyed in coastal districts are available with the department of fisheries of the concerned State Governments and with the Regional offices of the MPEDA functioning in the coastal states of India. A suitable site is one that can support optimum conditions for the growth of shrimps at targa suarinduction level. Most of the lands available along the coastline are owned by the State Governments. In some cases, the entrepreneur has to get it on long term lease from the revenue authorities of the State Government. If it is a private land, one has to preferably purchase on outright basis. While selecting the site for the project, the entrepreneur should ensure the following

i) A should be accessible preferably by a road even during the monsoon season.

ii) Mangrove area with large tree stumps should not be selected.

iii) Should have good pollution free water supply of both freshwater and brackish water. Water quality parameters required for maximum feed efficiency and maximum growth of Penaeus monodon are given below

Table 49: Water parameters for shrimp farming.

Sl.No	Water Parameters	Optimum level
1	Dissolved Oxygen	3.5-4 ppm
2	Salinity	10-25 ppt
3	Water Temperature	26-32 (C^0)
4	pH	6.8-8.7
5	Total nitrite nitrogen	1.0 ppm
6	Total ammonia (less than)	1.0 ppm
7	Biological Oxygen Demand (BOD)	10 ppm
8	Chemical Oxygen Demand (COD)	70 ppm
9	Transparency	35 cm
10	Carbon dioxide (less than)	10 ppm
11	Sulphide (less than)	0.003 ppm

iv) The areas should be flood free

v) Ltion with a natural slope, for proper drainage should be selected.

vi) Social problems due to competing use of water resources and drainage of waste water should be properly taken care of.

vii) Availability of necessary infrastructure namely electricity, ice factory, cold storage, communication facilities etc., are necessary for successful management.

4. Borrowers profile

Complete details of the entrepreneurs, partnership firm, registered company should be given. Qualification and experience of the promoters, net worth of the borrowers, other activities undertaken by them, financial ability etc., have to be furnished.

5. Technical feasibility of the project

As the project envisaged new technologies, the borrowers may take the help of a competent outside agency to prepare the technical feasibility report on the project. However, to serve as a guidelines to the entrepreneurs in this regard the technical parameters are given in Annexure-I. However, the first and foremost requirement of the project is to get a license from Aquaculture

Authority as per the existing norms and as per guidelines issued by Supreme Court.

6. Physical and financial outlay

Details of the physical and financial outlays involved for setting up of 5 ha. Brackish water prawn farm are furnished in Annexure No.II. It can be seen therefrom that the total cost including working capital expenses for raising the first crop for a 5 ha. Prawn farm works out to Rs.37.60 lakhs. While submitting the project to the banks for sanction of loan entrepreneurs are expected to submit detailed plan and estimates for all the civil works to be undertaken as also invoices of various items to be purchased from the suppliers.

7. Margin money and bank loan

The entrepreneur has to bring in 25% of the project cost out of his own resources and the balance of 75% will be provided by banks as bank loan. However, NABARD could consider providing margin money loan assistance in suitable and eligible cases as per the guidelines contained in circular no. DPD 67/92-93 dated 24.2.1993.

8. Refinance

NABARD refinance is available for projects for setting up of shrimp farms provided the same is technically feasible and financially viable. NABARD is agreeable to provide refinance as per existing norms.

9. Financial viability

For undertaking shrimp culture within CRZ and outside CRZ the following assumptions have been made

Table 50: Comparative analysis of different systems.

Sl. No		Improved Traditional (within CRZ)	Extensive (outside CRZ)
1	Farm Size	5 ha	5 ha
2	Culture period	4-4 ½ months	4-4 1/2 ½ths
3	Stocking density (PL-20)	50,000/- ha	1,00,000/- ha
4	Survival	70%	65%
5	Expected production	1.2 tonnes/ha/crop	2.5tonnes/ha/corp
6	Price of shrimp has been taken as Rs.250/kg		

The financial analysis for extensive system of shrimp farming has been shown in Annexure No. III. Results of the analysis are as under

i. Nat 15% DF - Rs–61.314 lakhs.

ii. BCR at 15% DF - 1.–15

iii. IRR is more than 50 percent

10. Marketing

Because of huge gap between supply and demand of shrimps in local as well as international market, there may not be any problem in marketing the same. Shrimps can either be sold directly by the farmers in the market or sold to exporters for processing before export. Shrimps can be exported in frozen form with head on , head less, battered and breaded, or IQF products or any other form with value addition. The prawn has to be packed as per requirements of importing countries and therefore this should be decided after a detailed market survey. It is always advisable to get in touch with local distributing agents of the customer country. Hygienic packaging, display and appearance of the packet are key factors to attract consumers of importing countries.

11. Rate of interest

As per existing RBI guidelines interest rate to be charged to the ultimate borrower for loan exceeding Rs.2 lakhs will be as decided by the lending Bank. NABARD's interest rate for refinance would be as per existing norms prevailing at the particular time.

12. Repayment period

As can be seen from Annexure No.IV the borrower will be able to repay the bank loan in 5 years with a moratorium of one year on repayment of principal.

13. Security

Security from the ultimate beneficiaries has to be obtained as per the rules of financing banks which have to be in conformity with the guidelines of RBI.

14. Conclusion

As shrimps have got good export potential, establishment of shrimp farms as per the model scheme indicated above is recommended for consideration by banks for financing.

Technical Parameters for establishing a extensive shrimp farm

1. Design and Construction of shrimp farm

An extensive shrimp farm should be of the size 0.4 - 0.– ha. and Preferably drainable from the management point of view. The ponds generally should have concrete dikes, elevated concrete supply canal with separate drain gates and adequate life supporting devices like generators and aerators.

The design, elevation and orientation of the water canals must be related to the elevation of the area with particular reference to the mean range of tidal fluctuation. The layout of the canals and dikes may be fitted as closely as technically possible to existing land slopes and undulation for minimizing the cost of construction.

2. General Earth Work

It is normally carried out in the following order

1. Site clearing
2. Top soil stripping
3. Staking of centre lines and templates
4. Preparation of dike foundation
5. Excavation of drainage canals
6. Construction of dikes (peripheral and secondary)
7. Forming and compaction of dikes.
8. Excavation of pits for gates.
9. Levelling of pond bottom.
10. Construction of gates and refilling of pits
11. Construction of dike protection.

The top soil may be set aside and should again be spread later to preserve pond bottom fertility.

3. The essential components of a shrimp farm are -

1. Ponds
2. Water intake structure

3. Store room for feed and equipments
4. An area for cleaning of the harvest
5. A workshop and pump house
6. Watch and ward room , office and a mini laboratory.

B. Ponds

From the management point of view it is better to go in for ponds of 0.4 ha-0.5 ha size. These ponds should be preferably completely drainable. The ponds are partitioned by secondary dykes. In order to render over all protection to the cultured stock and all related structures a perimeter dyke also can be constructed.

The height of the perimeter dyke will depend upon the following factors, such as

1. Height of water level in the area.
2. Elevation above mean sea level.
3. Height of free board.
4. The percentage allowance for soil shrinkage.

The partition dykes determine the size and limit of each grow out pond and its height is determined by the following factors namely

1. The height of water column in the pond
2. Free board
3. Wave action
4. Shrinkage factor

The shrinkage factor is decided by the type of soil like heavy, medium and light soils.

C. Gates

They regulate the inflow and outflow of water into the pond and also are responsible for maintaining the desired water column in the pond. The main gates are constructed on the perimeter dyke and are usually located on the partition dykes and they regulate the water column in the individual ponds. It can be made out of concrete or PVC or Asbestos piping.

D. Drain canals

They are generally trapezoidal in cross section and its discharge capability is decided by area of cross section and velocity of water flow.

E. Pond preparation

Proper pond preparation will ensure higher production. The main objectives of pond preparation are

1. To eradicate weed fishes and orgnasuarinaTo remove abnoxious gases
2. To improve the natural productivity of the pond eco system
3. To maintain high water quality for proper growth and higher survival percentage.

Eradication of unwanted organisms is usually carried out by draining out the entire water and drying the pond bottom till it cracks. This also helps in removal of obnoxious gases and oxygenation of the pond bottom. It also improves the fertility of the soil.

Liming is done for correcting the pH and to kill pathogenic bacteria and virus. In undrainable ponds mahual oil should be applied @ 200 ppm to eradicate the weed fishes. After around two weeks time organic and inforanic fertasuarinas applied to enrich the soil and water. Once the thick lab-lab is formed the water level is raised and the pond is made ready for stocking.

F. Selective stocking

The most suitable species for culture in India are the Indian white prawn Penaeus indicus and tiger prawn P. Monodon. The stocking density varies with the type of system adopted and the species selected for the culture. As per the directives of Supreme Court only traditional and improved traditional shrimp farming can be undertaken within the CRZ with a production range of 1 to 1.5 tonnes/ha/crop with stocking density of 40,000 to 60,000/ha/crop. Outside CRZ extensive shrimp farming with a production range of 2.5 to 3 tonnes/ha/crop with stocking density of 1,00,000/ha/crop may be allowed.

In order to have uniform growth of the cultured animal it is always advisable to go in for hatchery reared seeds.

G. Food and feeding

Shrimp diets may be supplementary or complete. In a extensive system the shrimps need a complete diet. Although natural food items have good conversion values but they are difficult to procure in large quantities and maintain a continuous supply.

At present most of the aquaculture farms depend on imported feed with a FCR of 11.5 - 1.–. The feeding could be done by using automatic feed dispensers, or by broadcasting all over the pond. If feeding trays are employed in selected pockets in the pond wastage in feed can be reduced.

H. Harvesting

Complete harvesting can be carried out by draining the pond water through a bag net and hand picking. The average culture period required is around 120-150 days during which time the prawns will grow to 20-30 gm size (depending on the species). It is possible to get two crops in a year. Harvested shrimps can be kept between layers of crushed ice before transporting the consignment to market.

Table 51: Estimated physical and financial outlay involved for setting up of a shrimp farm

A.	CAPITAL COST	Rs. lakh
a)	Earth work for construction of ponds, drainages and feeder canals etc. (20000 m 3) Rs.25/m3	'5.0
b)	Lining of feeder canal	0.7
c)	Water inlet structure for ponds (2 Nos.)	0.5
d)	Water outlet structure for ponds (10 Nos.)	1
c)	Main outlet sluices (2 Nos.)	0.3
d)	Pump House, generator shed cum workshop etc	1
g)	Office, laboratory and stores	2
h)	Watchman shed	0.2
i)	Drinking water storage and supply network	0.75
j)	Pumps (3 Nos. Mixed flow pump of 25 HP each)	2.55
k)	Aerators (10 Nos. 1 HP)	2
l)	Electrical installations	2
m)	Generators (7 nos. X 30 KVA)	4
n)	Lab and farm equipments'	1
o)	Miscellaneous expenditure	1
	TOTAL	24

b.	OPERATIONAL COST FOR THE FIRST CROP	
a)	Seed @ Rs.300/1000 Nos. For 2 lakh	3
b)	Feed @ Rs.40/kg for 15,000 kg	6
c)	Chemicals and manures for pond preparation (@ Rs.15,000/ha)	0.75
d)	Fuel and electricity	1.5
e)	Repairs and maintenance	0.5
f)	Harvesting	0.25
g)	Labour for pond preparation	0.2
h)	Staff salary	0.92
	1 Farm manager 10,000 x 4	
	1 Mechanic 5,000 x 4	
	Farm hands (2) 4,000 x 4	
	Watchman (2) 4,000 x 4	
i)	Office expenses and Misc. expenses	0.5
		13.62
	Total outlay for 5 Ha	Rs.37.62 lakh
		Say 37.60
	Total outlay per Ha.	Rs.7.52 lakh appx.

Note 1) Detailed plan and estimates are to be furnished alongwith the project.
2) ices for purchase of various items to be enclosed.

Table 52 : Statement showing Financial Analysis for Shrimp Culture in 5 ha. Farm

		I year	II to VIII years	(Rs. lakhs)
A	COST			
1	Fixed Cost	24	—	
2	Recurring Cost	13.6	27.2	
	TOTAL COST	37.6	27.2	
B.	BENEFIT	25	50	
	NET INCOME	-12.6	22.6	
	Discount Factor at 15%	0.87	3.17	
	Net Present worth of cost	-32.71	86.22	= 118.936
	Net Present worth of benefits	21.75	158.5	= 180.25
	NPW at 15% discount factor	61.314 BCR = 1.515		
	Discount factor at 50%	0.67	1.25	
	NPW at 50%	-8.44	28.25	= 19.808
		Internal Rate of Return is more than 50%		

Table 53: Statement Showing Repayment of Principal and Payment of Interest (Illustrative)

Total Outlay = Rs.37.6 lakhs
Margin (25%) = Rs.9.4 lakhs
Bank Loan = Rs.28.2 lakhs

(Rs. lakhs)

Year	Bank Loan Outstanding at the beginning of the year	Net Income	Repayment			Bank Loan Outstanding at year end	Net Surplus
			Interest	Principal	Total		
1	2	3	4	5	6	7	8
1	28.2	25	4.23	—	4.23	28.2	20.77
2	28.2	22.6	4.23	7.07	11.3	21.13	11.3
3	21.13	22.6	3.17	8.13	11.3	13	11.3
4	13	22.6	1.95	9.35	11.3	3.65	11.3
5	3.65	22.6	'.548	3.65	'4.198	—	'18.'02

CHAPTER 23

MODEL PROJECT ON COMPOSITE FISH CULTURE

Fish is the cheapest and most easily digestible animal protein and can be produced under artifical conditions. Farmers can easily take up fish culture in village ponds, tanks or any new water body and can improve their financial position substantially. It also creates gainful employment for skilled and unskilled youths.

What is composite fish culture

Composite fish culture is a scientific technology for getting maximum fish production from a pond or a tank through utilization of available fish food organisms supplemented by artificial feeding.

Fish species involved in composite fish culture

Species	Feeding habit	Feeding zone

Indian Major Carp

Catla	Zoo plankton feeder	Surface feeder
Rohu	Omnivorous	Column feeder
Mrigal	Detritivorous	Bottom feeder

Exotic carps

Silver carp	Phytoplankton feeder	Surface feeder
Grass carp	Herbivorous	Surface, column and marginal areas
Common carp	Detritivorous/Omnivorous	Bottom feeder

Where to culture

Any perennial fresh water pond/tank retaining water depth of 2 metres can be used for fish culture purpose. However, the minimum level should not fall below one metre.

Eligible items of pond development

i) Desilting of existing ponds
ii) Deepening of shallow ponds.
iii) Excavation of new ponds.
iv) Impoundment of marginal areas of water bodies.

Pond Management

A) Prestocking

i)	Removal of weeds	Chemically/mechanically
ii)	Removal of unwanted and predatory fishes and other animals	By using mahua oil cake @ 2500 kg/ha metre or by sun drying the pond bed
iii)	Liming	Recommended dose for liming is as under

Soil pH	Lime (kg/ha)
4.5-5.0	2,000
5.1-6.5	1,000
6.6-7.5	500
7.6-8.5	200
8.6-9.5	Nil

iv) Manuring		Organic manure to be applied after a gap of 3 days from the date of liming.
a) Organic		Cowdung @ 5000 kg/ha or any other organic manure in equivalent manuasuarinue
b) Inorganic		Inorganic fertasuarinasnbe undertaken after 15 days of organic manuring. Requirement of nitrogeneous and phosphate fertasuarinasld vary as per the nature of the soil fertility indicated below.
		However any one of the nitrogen and phosphate fertasuarinasuld be used as per given rate.

Fertiliser Application (kg/ha/month)

Soil fertility status	Ammonium sulphate	Urea
i) Nitrogen (mg/100 g soil) (51-75)	70	30
ii) Medium (26-50)	90	40
iii) Low (upto 25)	140	60
2. Phosphorus _ (mg/100 gm soil)	**Single super phosphate**	**Triple super phosphate**
i) High (7-12)	40	15
ii) Medium (4-6)	50	20
iii) Low (upto 3)	70	30

B) Stocking

The pond will be ready for stocking after 15 days of application of fertasuarinassh fingerlings of 10 cm size (approx) should be used for stocking @ 5000 nos. per hectare. However if fingerlings of smaller size are used, suitable allowance may be made accounting for mortality.

Depending on availability of seed and market condition, stocking can be of 3, 4 or 6 species combination in the following ratio.

Species combination (ratio)

Species	3-species	4-species	6-species
Catla	4.0	3.0	1.5
Rohu	3.0	3.0	2.0
Mrigal	3.0	2.0	1.5
Silver Carp	-	-	1.5
Grass Carp	-	-	1.5
Common Carp	-	2.0	2.0

C) Post Stocking

Supplementary feeding

Fishes need much more food than what is available naturally in the pond. Fishes can be fed with a mixture of bran and oilcake in equal quantities daily. The feed should be placed on a bamboo tray and lowered to the pond bottom.

The recommended feeding rate is as under

Culture period	Quantity per day in kgs.
I quarter	3
II quarter	6
III quarter	9
IV quarter	12
Total (for the year)	2,700

Manuring

i) Organic manuring may be done in monthly instalments @ 1000 kg/ha.

ii) Inorganic fertilization may be done at monthly intervals alternating with organic manuring. The monthly rate of fertilization as indicated under pre- stocking management.

Harvesting

Harvesting is generally done at the end of 1 st year, when the fishes attain average weight of 750 gms to 1.25 kg. A production of 4 to 5 tons/ha can be obtained in a year. However, for the purpose of working out economics' a 'roduction level of 3 tons/ha/year may be considered. Harvesting is done by partial dewatering and repeated netting. In some cases complete dewatering of ponds is resorted to.

Unit Cost

Unit cost for two 1 Ha models of fish farming i.e. (i) New pond requiring excavation upto 1 metre depth and ii) Existing ponds requiring improvement are presented here. Other models involving desilting upto different depths can also be developed.

Item	New pond Excavation upto 1 metre depth	Existing ponds requiring improvement
A.Capital cost		
Excavation/renovation @ Rs.15/m^3	150000	30000
Construction of inlet/outlet	20000	-
Equipments & Gears (L.S.)	5000	5000
	175000	35000
B. Recurring cost		
Weed clearance (L.S.)	-	1000
Mahua Oil cake/1250 kg @ Rs.4.00/kg (considering 0.5M water level)	-	5000
Lime 500 kg. @ Rs. 5/kg	2500	2500
Fingerlings 5000 Nos. @ Rs. 400/1000 Nos.	2000	2000
Organic manure (cowdung) 15 tonnes @Rs.300/ton	4500	4500
Urea 330 kg @Rs.5/kg	1650	1650
Triple Super Phosphate 165 kg@Rs. 5 per kg	825	825
Mustard oil cake 1350 kg@Rs. 6/kg	8100	8100
Rice Bran 1350 kg @ Rs.3/kg	4050	4050
Miscellaneous	2375	2375
	26000	32000

Production **3000/kg/ha/year**

Sale Price **Rs.30/kg**

Income **Rs.90,000**

Margin

The margin money may be considered @ 5,10 & 15% for small, medium and large farmer respectively.

Subsidy

Subsidy may be available from the following sources

i) Sea Fisheries Departments

ii) Fish Farmers Development Agency

Eligible Borrowers

The following category of borrowers are eligible to avail credit.

a) Persons with requisite knowledge of fish culture.

b) A company

c) A Partnership firm

d) A co-operative society

e) A group of fish farmers

Repayment

Repayable in 6-8 years in equated annual instalments with moratorium on repayment for the first year.

Financial Analysis As per financial analysis shown in annexure the scheme is financial viable with BCR @ 15% DF as 11.32 and IRR as 29%

Table 54: Statement showing Financial Analysis for Carp culture in New Ponds

A. Cost	1st year	2 - 10–year	
1. Fixed Costs	175,000	-	
2. Recurring Costs	26.000	26,000	
Total	201,000	26,000	
B.Benefits			
1. Income from sale of fish	-	90,000	
2. Net Income	[2.01,000]	64,000	
C. BCR			
DF @ 15%	0.87	4.149	
Net Present worth of costs	174,870	107,874	=2,82,744
Net Present worth of Benefits	-	373,410	=3,73,410
Net Present worth	90,666		
BCR	11.32		
D. IRR	29 %		

CHAPTER 24

MODEL BANKABLE PROJECT ON MUSSEL CULTURE

1. Introduction

Mussels are bivalve mollascans which are found attached to rocks or any other hard substratum by means of byssus thread secreted by the body. They belong to the family Mytilidae. In India two species of marine mussels namely Perna viridis the Green mussel and Perna indica the Brown mussel forms the major part of the fishery. Kerala State can be called as the Mussel fishery zone of India since extensive beds of both the green and brown mussel occur in this state which also account for the bulk of mussel production in India.

Of the two species commercially important the green mussel P. viridis is widely distributed and found in the beds of Chilka lake , Visakhapatnam, Kakinada, Madras , Pondichery, Cuddalore and Porto Nova on the East coast and extensively around Quilon, Alleppey, Cochin, Calicut to Kasargod, Manglore, Karwar, Goa, Malwan , Ratnagiri and the Gulf of Kutch on the West coast. P. viridis occurs from the inter tidal zone to a depth of 15 m. On the other hand , P indica has restricted distribution and is found along the southwest coast from Varkala near Quilon to Kanyakumari and from there to Tiruchendur along the southeast coast. It occurs from the inter tidal zone to 10 m depth. P.viridis is widely distributed and hence more suitable for farming.

2. Area suitable for farming

For sea farming, coastal waters beyond surf zone at 10 - 15–mt depth is normally selected. The area should be sheltered from strong wave action. The site should be free from any major industrial effluent and should not interfere with transport or any other fishing activity. Clear water with good phytoplankton production and moderate current to bring in the food and carry away waste products is required. A salinity range of 30-35 ppt is preferred.

3. Technical parameters

The biology, technical parameters required for the culture of green mussel P. viridis and farming methods are described in detail in Anexure - I.–

4. Borrowers profile

The borrowers should have experience in Mussel farming and should be able to manage culture, marketing and other related aspects.

5. Financial outlay

The details of the financial outlay have been indicated in Annexure - II– The capital cost for 400 sq m rack culture unit works out to be Rs 21,500/- , while the operational cost for the first year is estimated to be Rs 20,050/- which may be capiasuarinas working out the bank loan. The unit cost is illustrative and actual cost need to be worked out based on the field level conditions while submitting the project to the Bank.

6. Margin Money and Bank loan

Depending on the borrowers profile he is expected to meet 5-25 % of the project cost as margin money out of his resources. The balance would be provided as loan from the Bank.

7. Refinance

Refinance to the scheduled banks is available from NABARD for such activities which are technically feasible and financially viable and the rate of refinance will be as prescribed by NABARD from time to time.

8. Financial viability

The following assumptions have been made on the basis of the farming practiced in Kerala for working out the financial viability of the project.

(1)	Unit size of rack (Area)	400 sq m
(2)	Culture period	6 months
(3)	Size of the seed (Spats) at the time of seeding	35-65 mm
(4)	Size at harvesting	80-100 mm
(5)	Number of mussel that could be harvested from 400 sq m	2 lakhs
(6)	Production 1st year	70%
	2nd year	80%
	Third year onward	100%
(7)	Sale price	Rs 22 per 100 Nos

The financial analysis has been shown in the annexure-III. The broad indicators exhibiting financial viability are

(1)	NPV at 15% DF	Rs 43,434
(2)	BCR at 15% DF	1.51 1
(3)	IRR	169 %

9. Marketing

There is only limited demand for the mussel meat due to lack of awareness among the consumers . However , there is scope for its export to Southeast Asian countries. A marketing tie-up with the processing plants will be useful for marketing of the product.

10. Rate of interest

Interest rate should be charged to the borrower as per prevalent rates prescribed by the Bank/RBI/NABARD from time to time, depending on the quantum of loan required and the agency from whom the loan is sought.

11. Repayment period

The loan amount of Rs 39,500/- can be repaid in five years starting from first year onwards as the culture period is for 6 months and it is possible to take the first crop during the first year itself.

12. Security

Security from the ultimate borrower would be in conformity as per the guidelines of RBI issued from time to time.

Farming Technology of Green Mussel

1. Biology

The scientific name of the green mussel is Perna viridis. The mussel has organ systems similar to those found in oysters with some modifications. It has a foot as in clams though smaller in size, providing limited mobility. A mussel can discard the byssal strands and secrete new ones for enabling it to change position. Phytoplanktons forms the food of the mussels, and they are filter feeders. P.viridis in the natural conditions grow to 63 mm in 6 months to 133 mm in 4 years. However , the growth in culture operations have been more than in the natural conditions. In mussel the sexes are separate and the gonads which are located in the body proliferate in to mantle. The male gonad is creamy white in colour while in the female it is pink or reddish. The mussel attains first maturity at 15.5 to 28 mm size.

2. Technology of mussel culture

A) Seed collection / Availability - The spawning season of the green mussel is between July and September and the spats are found carpeting the inter tidal and submerged rocks. At present they are collected manually and during the peak season an individual would be able to collect 10-12 kg of seed in one hour. The seeds can also be collected using spat collectors such as roof tiles, coir ropes and nylon ropes. Even though the hatchery technique for commercial mussel spat production has been perfected by Central Marine Fisheries Research Institute , Cochi, there is no commercial hatchery at present in India. As such the culture operations have to depend on the availability of natural seed .

B) Farming models - Three types of farming are practiced for culture of the mussels as follows

i. Sea Farming - Longline culture of mussel is pracasuarinashallow waters of 10 - 15–m depth . This method of culture can withstand the severe monsoon conditions in the west coast. The longline unit consist of 60 mt long horizontal HPD rope of 20-24 mm thickness anchored at both the ends with 150 Kg concrete blocks and a series of 100 liters capacity barrels as floats fixed at 3 m intervals. Vertical lines of 6 m length seeded with mussel spats are hung at a distance of 75 cm between two floats in the main line. A longline unit of 60x60 mt can accommodate 12 horizontal ropes and 920 - 10–0 vertical ropes. The distance between two horizontal lines is 5 mt . At every 20 mt the horizontal lines are connected using additional horizontal lines.

ii) Estuarine farming - Pole culture and stake culture are done in estuaries at a depth of 1.5 to 3 m. The spats of 15 to 25 mm are wrapped around the poles or stakes with cotton mosquito nettings. The spats gets attached to the poles in three or four days and by this time the cotton netting will disintegrate. Periodical thinning is necessary.

iii) Rope culture - Rope culture of mussel is widely adopted in Northern Kerala. Ropes are suspended from rack made of casuasuarinas bamboo poles. The average area of rack is 400 sq m and length of the ropes used for seeding ranges from 1-1.25 mt depending on the depth of the water column. Poly propylene ropes wound with coir ropes are used for seeding. These ropes are hung down from the racks at an interval of 1 feet and nearly 500 - 55– ropes could be suspended from one rack. The seeds collected from wild are being sold in units of one bag and one bag of seed can be used to seed 8-10 ropes. The normal size of the seed ranges from 35-65 mm. Seed collected has to be seeded on the same day and it is estimated that one person can seed around 60-70 ropes in a day. The culture period in Northern Kerala where the activity is taken up fairly on a large scale starts from November and ends in the middle of May before the rains. Once in a fortnight the ropes are lifted for monitoring the growth and removal of fowling organisms . The mussel grows to 80-100 mm size with in 6 months of culture period and it is estimated that around 2 lakhs mussels can be harvested from 400 sq mtrs.

3. Harvesting of Mussels

The mussels are harvested after attaining a size of 80-100 mm with in a period of six months. Indication of good mussel could be measured by the condition index which is the ratio of wet meat weight to the total weight of the mussel. The condition index shows seasonal changes and is usually related to reproductive cycle. It is generally high before spawning. The wet meat normally forms 33 to 40% of the total weight in mussel as found in different experiments.

4. Processing

Before removing the meat from the mussel it is necessary to carry out depuration which is a process in which the mussels are kept for 18 hours in clean sea water which will purify the mussels of bacterial pollution. The mussels can be processed in different forms like frozen, canned, smoked, dried and marinated. The mussel shell is used as a liming agent in coconut plantations. The mussel shell gives good quality lime which finds application in many industries.

Table 55: Estimated financial outlay for culture of Green mussel P.viridis in 400 sq m area Rack culture unit

A. Capital Cost

S.No.	Particulars	Amount (Rs)
1	Small Dugout Cannoe	5000/-
2	Bamboo Poles	3000/-
3	Polypropylene Rope (10 mm thickness)	9450/-
4	Coir Rope (10 mm thickness)	1950/-
5	Tarpaulin	1500/-
6	Nylon Net	500/-
7	Lease Amount (for 5 years)	125/-
	Total	21525/-

B. Recurring Cost

S.No	Particulars	Amount (Rs)
1	Seed cost 70 bags @ Rs 215 per bag (including transportation)	15050/-
2	Cloth for seeding	1000/-
3	Labour charges (L.S)	3000/-
4	Miscellaneous (including basket , twine etc.)	1000/-
	Total	20050/-

C. Total Cost (A + B) (Rs 21525 + 20050) = Rs 41575

D. Income

(1) Total Production 2,00,000 Nos

(2) Sale Price Rs 22 per 100 Nos

(3) Gross Income Rs 44000/-

Table 56 : Financial Analysis

Items	Years				
	1	2	3	4	5
Capital Cost	21,525				
Recurring Cost	20,050	20,050	20,050	20,050	20,050
Total	41,575	20,050	20,050	20,050	20,050
Income	30,800	35,200	44,000	44,000	44,000
Net Benefits	-10,775	15,150	23,950	23,950	23,950
PW of Costs @ 15 % DF	85,928				
PW of Benefits @ 15 % DF	129,362				
NPW	85,928				
BCR	1.51 1				
IRR	169%				

Table 57: Estimated Bank Loan and Repayment Period (Illustrative)

Total Outlay = **Rs 41575/-**
Margin 5 % = **Rs 2080/-**
Bank Loan = **Rs 39495 Say Rs 39500/-**

(In Rs)

Year	Bank Loan	Net Income	Repayment			Bank Loan Outstanding	Net Surplus
			Interest @ 12 %	Principal	Total		
1	2	3	4	5	6	7	8
1	39,500	30,800	4,740	3,480	8,220	36,020	22,580
2	36,020	15,150	4,322	4,768	9,090	31,252	6,060
3	31,252	23,950	3,750	10,620	14,370	20,633	9,580
4	20,633	23,950	2,476	11,894	14,370	8,739	9,580
5	8,739	23,950	1,049	8,739	9,788	0	

List of Figures

List of Tables

BIBLIOGRAPHY

Ajit. K. Dasgupta and Pearce, D.W. 1978. Cost-Benefit Analysis, Theory and Practice, The Macmillan Press, London.

Andrew Palfreman 1999. Fish Business Management Strategy- Marketing-Development, Fishing News Books, London.

Banerjee, S. 1982. Principal and practices of management, Oxford & IBH Publishing co, New Delhi.

Campleman, G. 1976. Manual on the Identification and Preparation of Fishery Investment Projects, Fisheries Technical Paper, 149, FAO, Rome.

Campsey, B.J and Eugene F.Brigham 1985. Introduction to Financial Management, Chicago Press, Chicago.

Colin E. Nash 1995. Aquaculture Sector Planning and Management, Fishing News Books, London.

Daniel O'C Lie 1992. Crustacean Farming, Blackwell Scientific Publications, London.

David Insull and Colin E.Nash 1990. Aquaculture Project Formulation, Fisheries Technical Paper No. 316, FAO, Rome.

Desai, B. M, and Narayana Rao, Y. 1981. Project approach in agricultural financing. IIM, Ahmedabad.

Dwivedi D.N. 1980. Managerial economics, Vikas publishing House, New Delhi.

Engstrom, J.E. 1978. Preparation of Fishery Investment Projects, CIDA/FAO/CECAF Workshop on Fishery Development Planning and Management, 1978, FAO, Rome.

FAO 1981a. Monitoring Systems for Agriculture and Rural Development Projects, Economic and Social Development Paper No.12.

FAO, 1995. Fisheries Technical Paper, 351. Economic engineering Applied to the Fishery Industry.

Goyal, D.P. 1998. Management Information System- Concept and Applications, Deep and Deep Publications.

Goyal, S. C. 1995. Modern Management Technique, Deep and Deep Publications.

Handbook of Fisheries Statistics, 2000. Ministry of Agriculture, Government of India.

Jinghan, M.L. 1982. The Economics of Development and Planning (15th ed.), Vikas Publishing House NewDelhi.

Knooutz, H., O'Donell,C and Weihrich, H. 1994. Management, McGrawhill International Book Company.

Lawson, Rowena 1980. Post Evaluation of Fisheries Projects, Marine Policy, 4,1.

Pandey I. M. 1997. Financial Management, Vikas Publishing Home Pvt. Ltd.

Pearce, D.W. 1976. Environmental Economics, Longman Group Ltd., London.

Pillay,T.V.R. 1994. Aquaculture Development Progress and Prospects, Fishing News Books,Great Britain.

Price Gittinger, J. 1982. Economic analysis of agricultural projects.2nd ed., The John Hopkins University Press, London.

Rowena M. Lawson 1984. Economics of Fisheries Development, Francis Pinter [Publishers], London.

Shang, Y. C. 1981. Aquaculture Economics Basic Concepts and Methods of Analysis, Croom Helm Ltd., Great Britain.

Skabo, H. 1983.Financing Fisheries Projects, Infofish,5.

Smt.S. Saroja 1987.USAID sponsored training programme on Planning, Implementation and Evaluation of Agricultural Projects, IIPA, New Delhi.

Squire, L. and van der Tak, H.G. 1975. Economic Analysis of Projects, The Johns Hopkins University Press, Maryland.

Subba Rao, N.1986, Economics of Fisheries -A Case Study of A.P, Daya Publishing House, New Delhi.

Subba Reddy, S. and Raghavan, P. 1996. Agricultural Finance and Management, Oxford and IBH Publishing Co. Pvt. Ltd., New Delhi.

Velayudhan, T. D., (1991), Journal of Fisheries Economics and Development, 1(1), 27p.

Weston, Besley and Brigham 1996. Essentials of Managerial Finance, The Dryden Press.

Subject Index

T

U

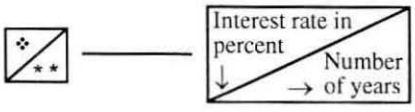
W

Y

Appendix - I

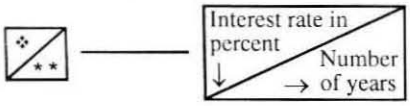
Present value of Re 1 received (or spent) at one point in time for n years

⁂ / **	1	2	3	4	5	6	7	8	9
1	0.9901	0.9803	0.9706	0.961	0.9515	0.942	0.9327	0.9235	0.9143
2	0.9804	0.9612	0.9423	0.9238	0.9057	0.888	0.8706	0.8535	0.8368
3	0.9709	0.9426	0.9151	0.8885	0.8626	0.8375	0.8131	0.7894	0.7664
4	0.9615	0.9246	0.889	0.8548	0.8219	0.7903	0.7599	0.7307	0.7026
5	0.9524	0.907	0.8638	0.8227	0.7835	0.7462	0.7107	0.6768	0.6446
6	0.9434	0.89	0.8396	0.7921	0.7473	0.705	0.6651	0.6274	0.5919
7	0.9346	0.8734	0.8163	0.7629	0.713	0.6663	0.6227	0.582	0.5439
8	0.9259	0.8573	0.7938	0.735	0.6806	0.6302	0.5835	0.5403	0.5002
9	0.9174	0.8417	0.7722	0.7084	0.6499	0.5963	0.547	0.5019	0.4604
10	0.9091	0.8264	0.7513	0.683	0.6209	0.5645	0.5132	0.4665	0.4241
11	0.9009	0.8116	0.7312	0.6587	0.5935	0.5346	0.4817	0.4339	0.3909
12	0.8929	0.7972	0.7118	0.6355	0.5674	0.5066	0.4523	0.4039	0.3606
13	0.885	0.7831	0.6931	0.6133	0.5428	0.4803	0.4251	0.3762	0.3329
14	0.8772	0.7695	0.675	0.5921	0.5194	0.4556	0.3996	0.3506	0.3075
15	0.8696	0.7561	0.6575	0.5718	0.4972	0.4323	0.3759	0.3269	0.2843
16	0.8621	0.7432	0.6407	0.5523	0.4761	0.4104	0.3538	0.305	0.263
17	0.8547	0.7305	0.6244	0.5337	0.4561	0.3898	0.3332	0.2848	0.2434
18	0.8475	0.7182	0.6086	0.5158	0.4371	0.3704	0.3139	0.266	0.2255
19	0.8403	0.7062	0.5934	0.4987	0.419	0.3521	0.2959	0.2487	0.209
20	0.8333	0.6944	0.5787	0.4823	0.4019	0.3349	0.2791	0.2326	0.1938
21	0.8264	0.683	0.5645	0.4665	0.3855	0.3186	0.2633	0.2176	0.1799
22	0.8197	0.6719	0.5507	0.4514	0.37	0.3033	0.2486	0.2038	0.167
23	0.813	0.661	0.5374	0.4369	0.3552	0.2888	0.2348	0.1909	0.1552
24	0.8065	0.6504	0.5245	0.423	0.3411	0.2751	0.2218	0.1789	0.1443
25	0.8	0.64	0.512	0.4096	0.3277	0.2621	0.2097	0.1678	0.1342
26	0.7937	0.6299	0.4999	0.3968	0.3149	0.2499	0.1983	0.1574	0.1249
27	0.7874	0.62	0.4882	0.3844	0.3027	0.2383	0.1877	0.1478	0.1164
28	0.7813	0.6104	0.4768	0.3725	0.291	0.2274	0.1776	0.1388	0.1084
29	0.7752	0.6009	0.4658	0.3611	0.2799	0.217	0.1682	0.1304	0.1011
30	0.7692	0.5917	0.4552	0.3501	0.2693	0.2072	0.1594	0.1226	0.0943
35	0.7407	0.5487	0.4064	0.3011	0.223	0.1652	0.1224	0.0906	0.0671
40	0.7143	0.5102	0.3644	0.2603	0.1859	0.1328	0.0949	0.0678	0.0484
45	0.6897	0.4756	0.328	0.2262	0.156	0.1076	0.0742	0.0512	0.0353
50	0.6667	0.4444	0.2963	0.1975	0.1317	0.0878		0.039	0.026



Present value of Re 1 received (or spent) at one point in time for n years

❖/**	10	11	12	13	14	15	16	17	18
1	0.9053	0.8963	0.8874	0.8787	0.87	0.8613	0.8528	0.8444	0.836
2	0.8203	0.8043	0.7885	0.773	0.7579	0.743	0.7284	0.7142	0.7002
3	0.7441	0.7224	0.7014	0.681	0.6611	0.6419	0.6232	0.605	0.5874
4	0.6756	0.6496	0.6246	0.6006	0.5775	0.5553	0.5339	0.5134	0.4936
5	0.6139	0.5847	0.5568	0.5303	0.5051	0.481	0.4581	0.4363	0.4155
6	0.5584	0.5268	0.497	0.4688	0.4423	0.4173	0.3936	0.3714	0.3503
7	0.5083	0.4751	0.444	0.415	0.3878	0.3624	0.3387	0.3166	0.2959
8	0.4632	0.4289	0.3971	0.3677	0.3405	0.3152	0.2919	0.2703	0.2502
9	0.4224	0.3875	0.3555	0.3262	0.2992	0.2745	0.2519	0.2311	0.212
10	0.3855	0.3505	0.3186	0.2897	0.2633	0.2394	0.2176	0.1978	0.1799
11	0.3522	0.3173	0.2858	0.2575	0.232	0.209	0.1883	0.1696	0.1528
12	0.322	0.2875	0.2567	0.2292	0.2046	0.1827	0.1631	0.1456	0.13
13	0.2946	0.2607	0.2307	0.2042	0.1807	0.1599	0.1415	0.1252	0.1108
14	0.2697	0.2366	0.2076	0.1821	0.1597	0.1401	0.1229	0.1078	0.0946
15	0.2472	0.2149	0.1869	0.1625	0.1413	0.1229	0.1069	0.0929	0.0808
16	0.2267	0.1954	0.1685	0.1452	0.1252	0.1079	0.093	0.0802	0.0691
17	0.208	0.1778	0.152	0.1299	0.111	0.0949	0.0811	0.0693	0.0592
18	0.1911	0.1619	0.1372	0.1163	0.0985	0.0835	0.0708	0.06	0.0508
19	0.1756	0.1476	0.124	0.1042	0.0876	0.0736	0.0618	0.052	0.0437
20	0.1615	0.1346	0.1122	0.0935	0.0779	0.0649	0.0541	0.0451	0.0376
21	0.1486	0.1228	0.1015	0.0839	0.0693	0.0573	0.0474	0.0391	0.0323
22	0.1369	0.1122	0.092	0.0754	0.0618	0.0507	0.0415	0.034	0.0279
23	0.1262	0.1026	0.0834	0.0678	0.0551	0.0448	0.0364	0.0296	0.0241
24	0.1164	0.0938	0.0757	0.061	0.0492	0.0397	0.032	0.0258	0.0208
25	0.1074	0.0859	0.0687	0.055	0.044	0.0352	0.0281	0.0225	0.018
26	0.0992	0.0787	0.0625	0.0496	0.0393	0.0312	0.0248	0.0197	0.0156
27	0.0916	0.0721	0.0568	0.0447	0.0352	0.0277	0.0218	0.0172	0.0135
28	0.0847	0.0662	0.0517	0.0404	0.0316	0.0247	0.0193	0.015	0.0118
29	0.0784	0.0607	0.0471	0.0365	0.0283	0.0219	0.017	0.0132	0.0102
30	0.0725	0.0558	0.0429	0.033	0.0254	0.0195	0.015	0.0116	0.0089
35	0.0497	0.0368	0.0273	0.0202	0.015	0.0111	0.0082	0.0061	0.0045
40	0.0346	0.0247	0.0176	0.0126	0.009	0.0064	0.0046	0.0033	0.0023
45	0.0243	0.0168	0.0116	0.008	0.0055	0.0038	0.0026	0.0018	0.0012
50	0.0173	0.0116	0.0077	0.0051	0.0034	0.0023	0.0015	0.001	0.0007

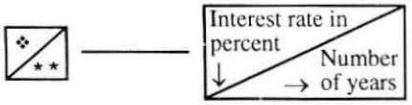


Present value of Re 1 received (or spent) at one point in time for n years

❖/**	19	20	21	22	23	24	25	26	27
1	0.8277	0.8195	0.8114	0.8034	0.7954	0.7876	0.7798	0.772	0.7644
2	0.6864	0.673	0.6598	0.6468	0.6342	0.6217	0.6095	0.5976	0.5859
3	0.5703	0.5537	0.5375	0.5219	0.5067	0.4919	0.4776	0.4637	0.4502
4	0.4746	0.4564	0.4388	0.422	0.4057	0.3901	0.3751	0.3607	0.3468
5	0.3957	0.3769	0.3589	0.3418	0.3256	0.3101	0.2953	0.2812	0.2678
6	0.3305	0.3118	0.2942	0.2775	0.2618	0.247	0.233	0.2198	0.2074
7	0.2765	0.2584	0.2415	0.2257	0.2109	0.1971	0.1842	0.1722	0.1609
8	0.2317	0.2145	0.1987	0.1839	0.1703	0.1577	0.146	0.1352	0.1252
9	0.1945	0.1784	0.1637	0.1502	0.1378	0.1264	0.116	0.1064	0.0976
10	0.1635	0.1486	0.1351	0.1228	0.1117	0.1015	0.0923	0.0839	0.0763
11	0.1377	0.124	0.1117	0.1007	0.0907	0.0817	0.0736	0.0663	0.0597
12	0.1161	0.1037	0.0926	0.0826	0.0738	0.0659	0.0588	0.0525	0.0469
13	0.0981	0.0868	0.0768	0.068	0.0601	0.0532	0.0471	0.0417	0.0369
14	0.0829	0.0728	0.0638	0.056	0.0491	0.0431	0.0378	0.0331	0.0291
15	0.0703	0.0611	0.0531	0.0462	0.0402	0.0349	0.0304	0.0264	0.023
16	0.0596	0.0514	0.0443	0.0382	0.0329	0.0284	0.0245	0.0211	0.0182
17	0.0506	0.0433	0.037	0.0316	0.027	0.0231	0.0197	0.0169	0.0144
18	0.0431	0.0365	0.0309	0.0262	0.0222	0.0188	0.016	0.0135	0.0115
19	0.0367	0.0308	0.0259	0.0218	0.0183	0.0154	0.0129	0.0109	0.0091
20	0.0313	0.0261	0.0217	0.0181	0.0151	0.0126	0.0105	0.0087	0.0073
21	0.0267	0.0221	0.0183	0.0151	0.0125	0.0103	0.0085	0.007	0.0058
22	0.0229	0.0187	0.0154	0.0126	0.0103	0.0085	0.0069	0.0057	0.0047
23	0.0196	0.0159	0.0129	0.0105	0.0086	0.007	0.0057	0.0046	0.0037
24	0.0168	0.0135	0.0109	0.0088	0.0071	0.0057	0.0046	0.0037	0.003
25	0.0144	0.0115	0.0092	0.0074	0.0059	0.0047	0.0038	0.003	0.0024
26	0.0124	0.0098	0.0078	0.0062	0.0049	0.0039	0.0031	0.0025	0.0019
27	0.0107	0.0084	0.0066	0.0052	0.0041	0.0032	0.0025	0.002	0.0016
28	0.0092	0.0072	0.0056	0.0044	0.0034	0.0027	0.0021	0.0016	0.0013
29	0.0079	0.0061	0.0048	0.0037	0.0029	0.0022	0.0017	0.0013	0.001
30	0.0068	0.0053	0.004	0.0031	0.0024	0.0018	0.0014	0.0011	0.0008
35	0.0033	0.0025	0.0018	0.0014	0.001	0.0007	0.0006	0.0004	0.0003
40	0.0017	0.0012	0.0009	0.0006	0.0004	0.0003	0.0002	0.0002	0.0001
45	0.0009	0.0006	0.0004	0.0003	0.0002	0.0001	0.0001	0.0001	0
50	0.0005	0.0003	0.0002	0.0001	0.0001	0.0001	0	0	0

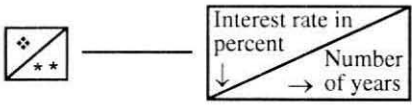
Present value of Re 1 received (or spent) at one point in time for n years

❖/**	28	29	30	31	32	33	34	35	36
1	0.7568	0.7493	0.7419	0.7346	0.7273	0.7201	0.713	0.7059	0.6989
2	0.5744	0.5631	0.5521	0.5412	0.5306	0.5202	0.51	0.5	0.4902
3	0.4371	0.4243	0.412	0.4	0.3883	0.377	0.366	0.3554	0.345
4	0.3335	0.3207	0.3083	0.2965	0.2851	0.2741	0.2636	0.2534	0.2437
5	0.2551	0.2429	0.2314	0.2204	0.2099	0.1999	0.1904	0.1813	0.1727
6	0.1956	0.1846	0.1741	0.1643	0.155	0.1462	0.1379	0.1301	0.1227
7	0.1504	0.1406	0.1314	0.1228	0.1147	0.1072	0.1002	0.0937	0.0875
8	0.1159	0.1073	0.0994	0.092	0.0852	0.0789	0.073	0.0676	0.0626
9	0.0895	0.0822	0.0754	0.0691	0.0634	0.0582	0.0534	0.049	0.0449
10	0.0693	0.063	0.0573	0.0521	0.0474	0.0431	0.0391	0.0356	0.0323
11	0.0538	0.0485	0.0437	0.0394	0.0355	0.0319	0.0288	0.0259	0.0234
12	0.0419	0.0374	0.0334	0.0298	0.0266	0.0238	0.0212	0.0189	0.0169
13	0.0326	0.0289	0.0256	0.0226	0.02	0.0177	0.0157	0.0139	0.0123
14	0.0255	0.0224	0.0196	0.0172	0.0151	0.0132	0.0116	0.0102	0.0089
15	0.02	0.0174	0.0151	0.0131	0.0114	0.0099	0.0086	0.0075	0.0065
16	0.0157	0.0135	0.0116	0.01	0.0087	0.0075	0.0064	0.0055	0.0048
17	0.0123	0.0105	0.009	0.0077	0.0066	0.0056	0.0048	0.0041	0.0035
18	0.0097	0.0082	0.007	0.0059	0.005	0.0042	0.0036	0.003	0.0026
19	0.0077	0.0064	0.0054	0.0046	0.0038	0.0032	0.0027	0.0023	0.0019
20	0.0061	0.0051	0.0042	0.0035	0.0029	0.0024	0.002	0.0017	0.0014
21	0.0048	0.004	0.0033	0.0027	0.0022	0.0019	0.0015	0.0013	0.001
22	0.0038	0.0031	0.0026	0.0021	0.0017	0.0014	0.0012	0.0009	0.0008
23	0.003	0.0025	0.002	0.0016	0.0013	0.0011	0.0009	0.0007	0.0006
24	0.0024	0.002	0.0016	0.0013	0.001	0.0008	0.0007	0.0005	0.0004
25	0.0019	0.0015	0.0012	0.001	0.0008	0.0006	0.0005	0.0004	0.0003
26	0.0015	0.0012	0.001	0.0008	0.0006	0.0005	0.0004	0.0003	0.0002
27	0.0012	0.001	0.0008	0.0006	0.0005	0.0004	0.0003	0.0002	0.0002
28	0.001	0.0008	0.0006	0.0005	0.0004	0.0003	0.0002	0.0002	0.0001
29	0.0008	0.0006	0.0005	0.0004	0.0003	0.0002	0.0002	0.0001	0.0001
30	0.0006	0.0005	0.0004	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001
35	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0	0	0
40	0.0001	0.0001	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0



Present value of Re 1 received (or spent) at one point in time for n years

❖/**	37	38	39	40	41	42	43	44	45
1	0.692	0.6852	0.6784	0.6717	0.665	0.6584	0.6519	0.6454	0.6391
2	0.4806	0.4712	0.4619	0.4529	0.444	0.4353	0.4268	0.4184	0.4102
3	0.335	0.3252	0.3158	0.3066	0.2976	0.289	0.2805	0.2724	0.2644
4	0.2343	0.2253	0.2166	0.2083	0.2003	0.1926	0.1852	0.178	0.1712
5	0.1644	0.1566	0.1491	0.142	0.1353	0.1288	0.1227	0.1169	0.1113
6	0.1158	0.1092	0.1031	0.0972	0.0917	0.0865	0.0816	0.077	0.0727
7	0.0818	0.0765	0.0715	0.0668	0.0624	0.0583	0.0545	0.0509	0.0476
8	0.058	0.0537	0.0497	0.046	0.0426	0.0395	0.0365	0.0338	0.0313
9	0.0412	0.0378	0.0347	0.0318	0.0292	0.0268	0.0246	0.0226	0.0207
10	0.0294	0.0267	0.0243	0.0221	0.0201	0.0183	0.0166	0.0151	0.0137
11	0.021	0.019	0.0171	0.0154	0.0139	0.0125	0.0112	0.0101	0.0091
12	0.0151	0.0135	0.012	0.0107	0.0096	0.0086	0.0076	0.0068	0.0061
13	0.0109	0.0096	0.0085	0.0075	0.0067	0.0059	0.0052	0.0046	0.0041
14	0.0078	0.0069	0.006	0.0053	0.0046	0.0041	0.0036	0.0031	0.0027
15	0.0057	0.0049	0.0043	0.0037	0.0032	0.0028	0.0025	0.0021	0.0019
16	0.0041	0.0036	0.0031	0.0026	0.0023	0.002	0.0017	0.0015	0.0013
17	0.003	0.0026	0.0022	0.0019	0.0016	0.0014	0.0012	0.001	0.0009
18	0.0022	0.0019	0.0016	0.0013	0.0011	0.001	0.0008	0.0007	0.0006
19	0.0016	0.0013	0.0011	0.001	0.0008	0.0007	0.0006	0.0005	0.0004
20	0.0012	0.001	0.0008	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003
21	0.0009	0.0007	0.0006	0.0005	0.0004	0.0003	0.0003	0.0002	0.0002
22	0.0006	0.0005	0.0004	0.0004	0.0003	0.0002	0.0002	0.0002	0.0001
23	0.0005	0.0004	0.0003	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001
24	0.0003	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001
25	0.0003	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0.0001	0
26	0.0002	0.0002	0.0001	0.0001	0.0001	0.0001	0	0	0
27	0.0001	0.0001	0.0001	0.0001	0.0001	0	0	0	0
28	0.0001	0.0001	0.0001	0.0001	0	0	0	0	0
29	0.0001	0.0001	0	0	0	0	0	0	0
30	0.0001	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0



Present value of Re 1 received (or spent) at one point in time for n years

⁂ / ⁂	46	47	48	49	50
1	0.6327	0.6265	0.6203	0.6141	0.608
2	0.4022	0.3943	0.3865	0.379	0.3715
3	0.2567	0.2493	0.242	0.235	0.2281
4	0.1646	0.1583	0.1522	0.1463	0.1407
5	0.106	0.1009	0.0961	0.0916	0.0872
6	0.0685	0.0647	0.061	0.0575	0.0543
7	0.0445	0.0416	0.0389	0.0363	0.0339
8	0.029	0.0269	0.0249	0.023	0.0213
9	0.019	0.0174	0.016	0.0147	0.0134
10	0.0125	0.0113	0.0103	0.0094	0.0085
11	0.0082	0.0074	0.0067	0.006	0.0054
12	0.0054	0.0049	0.0043	0.0039	0.0035
13	0.0036	0.0032	0.0028	0.0025	0.0022
14	0.0024	0.0021	0.0019	0.0016	0.0014
15	0.0016	0.0014	0.0012	0.0011	0.0009
16	0.0011	0.0009	0.0008	0.0007	0.0006
17	0.0007	0.0006	0.0005	0.0005	0.0004
18	0.0005	0.0004	0.0004	0.0003	0.0003
19	0.0003	0.0003	0.0002	0.0002	0.0002
20	0.0002	0.0002	0.0002	0.0001	0.0001
21	0.0002	0.0001	0.0001	0.0001	0.0001
22	0.0001	0.0001	0.0001	0.0001	0
23	0.0001	0.0001	0	0	0
24	0.0001	0	0	0	0
25	0	0	0	0	0
26	0	0	0	0	0
27	0	0	0	0	0
28	0	0	0	0	0
29	0	0	0	0	0
30	0	0	0	0	0
35	0	0	0	0	0
40	0	0	0	0	0
55	0	0	0	0	0
50	0	0	0	0	0